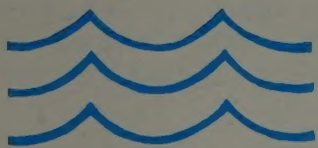


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SELECTED



WATER

RESOURCES

ABSTRACTS



VOLUME 4, NUMBER 3
FEBRUARY 1, 1971

SELECTED WATER RESOURCES ABSTRACTS is published semimonthly for the Water Resources Scientific Information Center (WRSIC) by the National Technical Information Service (NTIS), U.S. Department of Commerce. NTIS was established September 2, 1970, as a new primary operating unit under the Assistant Secretary of Commerce for Science and Technology to improve public access to the many products and services of the Department. Information services for Federal scientific and technical report literature previously provided by the Clearinghouse for Federal Scientific and Technical Information will now be provided by NTIS.

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center,
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VOLUME 4, NUMBER 3
FEBRUARY 1, 1971

W71-01101 -- W71-01650

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WATER RESOURCES ABSTRACTS

As the Nation's principal conservation agency, the Department of the Interior has basic responsibilities for water, fish, wildlife, mineral, land, park, and recreational resources. Indian and Territorial affairs are other major concerns of America's "Department of Natural Resources."

The Department works to assure the wisest choice in managing all our resources so each will make its full contribution to a better United States—now and in the future.



U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

WASHINGTON, D. C. 20090

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus** (November 1966 edition). Each abstract entry is classified into ten fields and sixty groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on inside back cover.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1954, as well as input from the grantees and contractors of the Office of Water Resources Research and other Federal water resources agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Resources Research
U.S. Department of the Interior
Washington, D. C. 20240

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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

01. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

THE DIELECTRIC RELAXATION SPECTRA OF WATER, ICE, AND AQUEOUS SOLUTIONS AND THEIR INTERPRETATION. VIII. TRANSFER OF PROTONS THROUGH 'PURE' ICE I (h) SINGLE CRYSTALS. I. POLARIZATION AND CONDUCTION. III. EXTRINSIC-VERSUS INTRINSIC POLARIZATION: SURFACE VERSUS VOLUME CONDUCTION, Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.

Author R. von Hippel, Dieter B. Knoll, Modesto A. Maidique, and W. B. Westphal.
Available from NTIS as AD-702 073, \$3.00 in paper copy, \$0.95 in microfiche. See also AD-689 379, February 1970. Various pagings. Technical Report 8. Contract No. N00014-67-A-0204-0003.
Identifiers: *Ice, Dielectric properties, Single crystals, Crystal growth, Carriers, Semiconductors, Electrical conductance, Adsorption, Spectrum, Polarization, Crystal lattice defects, Doping, Dielectric spectroscopy, Transconductance.

The report consists of three scientific papers, the outcome of three years of experimental work on ice I (h) single crystals and its theoretical interpretation. In the first paper a short description is given of crystal growing and sample handling techniques and of equipment covering the range (10 to the 5th) to (8 x 10 to the -3rd) Hz, OC to -180C. Rigorous control of error limits and an improved computerized evaluation procedure alloys to resolve the dielectric spectrum of ice into four significant components with very characteristic trends. The interpretation of these data requires new models developed in the second paper. The third paper supplements the a-c polarization studies by d-c and transient measurements ranging from 0.01 to 40000 V/cm, from nanoamperes to microamp, and from 100 microseconds to 3 hrs. It appears that an ideal ice crystal seems really to have no ionic charge carrier transport through its volume but a very strong one along its surfaces. Instead of a saturation current we find a small extrinsic saturation charge, extractable in high fields and giving no evidence of a special proton transfer mechanism across hydrogen bridges. Aged single crystal samples show six clearly separated relaxation spectra. Many contradictory statements in the literature about activation energies of conduction, etc., become clarified experimentally and understood.
W71-01127

SEDIMENTATION AND FREE HYDROGEN (IN RUSSIAN), V. I. Molchanov.
Doklady Akademii nauk SSSR, Vol 182, No. 2, p 445-448, 1968. 1 tab, 9 ref

Descriptors: *Sediments, *Hydrogen, *Organic matter, Mineralogy, Iron, Sulfur, Oxidation, Oil, Natural gas.
Identifiers: Hydrocarbons.

A previous study demonstrated that iron of finely ground minerals is oxidized in water with a release of free hydrogen. The latter is capable, in combination with organic matter, to form hydrocarbons. Similar transformations take place under the influence of finely dispersed matter containing sulfur. Because a large part of clay shales, slates, and argillites is enriched in organic matter, a hypothesis is advanced that such sedimentary rocks may serve as a source of hydrogen effecting the formation of oil, natural gas, and other hydrocarbons. (Wilde-Wisconsin)
W71-01472

02. WATER CYCLE

2A. General

USING EXPERIMENTAL MODELS TO GUIDE DATA GATHERING, General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
For primary bibliographic entry see Field 02F.
W71-01194

LIST OF INTERNATIONAL HYDROLOGICAL DECADE STATIONS OF THE WORLD.

UNESCO Studies and Reports in Hydrology No 6, Paris, France, 1969, 148 p.

Descriptors: *International Hydrological Decade, *Data collections, *Stations, Networks, Surface waters, Lakes, Groundwater, Evaporation, Soil moisture, Hydrology.

The list includes the names and principal characteristics of all stations selected by the National Committees of countries participating in the Decade to carry out observations on the following hydrological elements: water discharge of rivers, observations on lakes, evaporation from the water surface, evaporation from the soil, groundwater regime. For greater convenience in finding a particular station, information on Decade Stations is presented in five tables: I. River stations; II. Lake stations; III. Pan-evaporation stations; IV. Lysimeter stations; V. Groundwater stations. In each of these tables information is given by continent and within each continent countries are listed in English alphabetical order. The names of the stations are given in one of the four working languages of Unesco, as listed by the country preparing the information; the Russian station names have been transliterated. (Woodard-USGS)
W71-01208

EVALUATION OF SIMULATION MODELS FOR RIVER RUNOFF THROUGH NYQUIST PLOTS, Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-01218

SIMULATION OF A RIVER THERMAL BEHAVIOR FROM DATA OBTAINED BY A CLASSICAL METEOROLOGICAL NETWORK (FRENCH), Electricite de France, Chatou.
R. Gras.

In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 491-502, 1969. 12 p, 4 fig, append.

Descriptors: *Heat budget, *Rivers, *Water temperature, Heat balance, Meteorological data, Evaporation.
Identifiers: France.

The temperature of a river may be computed by the heat budget method using data given by a meteorological network. This temperature is generated without knowing the upstream temperatures; the heat budget method allows study of the temperature evolution along a river stretch with artificial perturbations. Two applications are discussed, one on the Moselle River, France, near Blenod and the other on the Marne River where the natural temperature upstream from Vaires power plant and the river cooling downstream are computed. (Knapp-USGS)
W71-01221

AN ANALYSIS OF RUNOFF MODELS, Nagoya Univ. (Japan). Dept. of Civil Engineering. Fusetsu Takagi.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 145-155, 1969. 11 p, 9 fig, 1 ref.

Descriptors: *Rainfall-runoff relationships, *Mathematical models, *Hydrograph analysis, Subsurface runoff, Confined water, Percolating water, Parametric hydrology, Model studies, Runoff forecasting, Streamflow forecasting, Surface-groundwater relationships.
Identifiers: Kinematic wave theory.

An analytical study of runoff models is based on the kinematic view of groundwater runoff. Groundwater runoff may be characterized by the two components, one due to confined aquifers and the other to unconfined aquifers. Equations are derived for the variation of these components, and the physical significance of the parameters in the equation is discussed. Comparisons are made between the estimated and the observed hydrographs for an existing river; their correlations are good. (Knapp-USGS)
W71-01232

A STOCHASTIC MODEL TO SIMULATE MONTHLY RIVER FLOW SEQUENCES, Osaka Univ. (Japan). Hydraulics Lab.
For primary bibliographic entry see Field 04A.
W71-01233

A NEW RATIONAL METHOD FOR CALCULATION OF MAXIMUM FLOOD DISCHARGE BY AMOUNT OF RAINFALL IN THE CATCHMENT, Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-01234

INDIRECT DETERMINATION OF SYNTHETIC RUNOFF, Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div. Donn G. DeCoursey, and Edward H. Seely.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 123-131, 1969. 9 p, 3 fig, 1 tab, 6 ref.

Descriptors: *Synthetic hydrology, *Simulation analysis, *Mathematical models, *Stochastic processes, *Statistical models, Rainfall-runoff relationships, Regime, Lane use, Soil moisture, Evapotranspiration, Water balance, Hydrologic budget, Streamflow forecasting, Runoff forecasting.
Identifiers: Synthetic runoff series.

Synthetic sequences of daily storm runoff were generated for an 1,110-acre watershed in Texas, using both deterministic and stochastic elements. The watershed model, a function of land use, soil moisture, and evaporation, is deterministic in that a functional relation exists between the inputs and the model response. However, a probabilistic element was fitted to the unexplained variance of the watershed response. Inputs to the system are stochastic and consist of daily rainfall and evaporation. A two-state Markov chain of transition probabilities is used to calculate the occurrence or nonoccurrence of rainfall. The amount of rainfall is uncorrelated with previous rainfall or length of dry period. Monthly evaporation is correlated with the previous month's evaporation and present month's rainfall. (Knapp-USGS)
W71-01235

Field 02—WATER CYCLE

Group 2A—General

ANALOG COMPUTERS FOR FOREST HYDROLOGY RESEARCH, Washington Univ., Seattle. Inst. of Forest Products. For primary bibliographic entry see Field 07C. W71-01411

EFFECTS OF FOREST CUTTING AND HERBICIDE TREATMENT ON NUTRIENT BUDGETS IN THE HUBBARD BROOK WATERSHED-ECOSYSTEM, Dartmouth Coll., Hanover, N.H. Dept. of Biological Sciences; Yale Univ., New Haven, Conn. School of Forestry; Geological Survey, Washington, D.C.; and Forest Service, (USDA), Durham, N.H. Northeastern Forest Experiment Station. Gene E. Likens, F. Herbert Bormann, Noye M. Johnson, D. W. Fisher, and Robert S. Pierce. Ecological Monographs, Vol 40, No 1, p 23-47, 1970. 15 fig, 8 tab, 54 ref.

Descriptors: *Forests, *Cutting management, *Herbicides, *Nutrients, *Ecosystems, *Watersheds (Basins), Streamflow, Ions, Nitrates, Sulfates, Drainage water, Dissolved solids, Nitrogen cycle, Hydrogen ion concentration, Temperature, Electrical conductance, Dissolved oxygen, Air pollution, Chemical analysis, Eutrophication, Transpiration, Precipitation (Atmospheric), Runoff, Evaporation, Geologic formations, Dusts, Turbidity, Erosion, Conductivity, Chlorides, Silica, Ammonia, Microorganisms, Algae, Calcium, Magnesium, Potassium, Sodium, Aluminum, Bicarbonates, Nitrification, Seasonal. Identifiers: *Hubbard Brook Experimental Forest, Particulate matter, Nitrosomonas, Nitrobacter, Thiobacillus thiooxidans, Desulfovibrio, Ulothrix zonata.

Quantity and quality of drainage waters were significantly altered following deforestation of a northern hardwoods watershed-ecosystem. Annual water runoff exceeded expected value (based on undisturbed watershed) by 39% during first water-year after deforestation and 28% during the second. Deforestation resulted in large increases in concentrations of all major ions except ammonium, sulfate, and carbonic acid, with greatest increase for nitrate in streamwater. Sulfate was the only major ion that decreased after deforestation. In undisturbed watersheds, streamwater has a pH of about 5.1 from sulfuric acid, whereas after deforestation it became a nitric acid solution of pH 4.3 enriched in metallic ions and dissolved silica. The increase in nitrate concentration in precipitation may somewhat increase air pollution. Greatly increased export of dissolved nutrients from the deforested ecosystem was due to an alteration of the ecosystem nitrogen cycle. Increased availability of nitrate and hydrogen ions resulted from nitrification. Total new export of dissolved inorganic substances was 14-15 times greater than from natural ecosystems. The deforestation experiment resulted in significant pollution of the drainage stream, with nitrate concentration exceeding the maximum recommended for drinking water. A bloom of algae appeared each summer. (Jones-Wisconsin) W71-01489

ALGORITHMS FOR PSYCHROMETRIC CALCULATIONS (SKELETON TABLES FOR THE THERMODYNAMIC PROPERTIES OF MOIST AIR), National Bureau of Standards, Washington, D.C. Building Research Div. T. Kusuda. Available from NTIS as PB-189 459, \$0.95 in microfiche. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Price \$0.55. Building Sciences Series 21, January 1970. 50 p. Identifiers: *Humidity, Thermodynamics, *Air, Altitude, Hygrometers, Moisture, Tables, *Psychrometric charts.

Computer algorithms to obtain thermodynamic properties of saturated and unsaturated moist air are presented in the paper. Sample calculations were performed using a computer program based

upon the algorithms presented herein and the results are attached. W71-01529

VARIATION OF URBAN RUNOFF WITH DURATION AND INTENSITY OF STORMS, Texas Tech Univ., Lubbock. Water Resources Center. For primary bibliographic entry see Field 05B. W71-01546

2B. Precipitation

EFFECTS OF SIMULATED CLOUD SEEDING ON STREAMFLOW OF SELECTED WATERSHEDS IN PENNSYLVANIA, Pennsylvania State Univ., University Park. School of Forest Resources. For primary bibliographic entry see Field 03B. W71-01116

CLOUD SEEDING EXPERIMENT - TASMANIA, 1965 - 1966 ANNUAL REPORT, Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Radiophysics Lab. For primary bibliographic entry see Field 03B. W71-01129

RAINFALL DEFICIENCIES OF THE PLATEAU OF TANZANIA, National Academy of Sciences-National Research Council, Washington, D.C. Foreign Field Research Program. William C. Kuepper, III. Available from NTIS as AD-703 233, \$3.00 in paper copy, \$0.95 in microfiche. PhD Thesis, Univ. of Wisconsin, July 1968. 220 p. Contract N00014-67-A-0244-0001. Identifiers: *Rainfall, Subsaharan Africa, Atmospheric motion, Diurnal variations, Intensity, Atmosphere models, Moisture, Humidity, Atmospheric temperature, Plants (Botany), Terrain, Haze, Cumulus clouds, Storms, Tropical regions, Tanzania, Westerlies, *Rainfall deficiencies, Monsoons.

The report contains a descriptive-explanatory climatology that concentrates on those aspects of climatic controls which make the Plateau of Tanzania unusually dry. Synoptic models are used to help explain climatology and rainfall patterns in East Africa. The main portion of the study is a season by season examination of: one, the rainfall patterns of this unusually dry area, and two, the unique aspects of the climatic and synoptic features of the atmosphere which create the seasonal and regional rainfall patterns. W71-01151

SOME PROBLEMS CONCERNING THE TECHNIQUE OF SEEDING SUPERCOOLED STRATUS CLOUDS FOR THE PURPOSE OF SCATTERING THEM, Foreign Technology Div., Wright-Patterson AFB, Ohio. For primary bibliographic entry see Field 03B. W71-01164

THE DETERMINATION OF SUITABLE AVERAGE VALUES OF METEOROLOGICAL DATA FOR USE IN ESTIMATION OF EVAPOTRANSPIRATION, North Dakota Water Resources Research Inst., Fargo. For primary bibliographic entry see Field 02D. W71-01190

SIMULATION OF A RIVER THERMAL BEHAVIOR FROM DATA OBTAINED BY A

CLASSICAL METEOROLOGICAL NETWORK (FRENCH), Electricite de France, Chatou. For primary bibliographic entry see Field 02A. W71-01221

MICROMETEOROLOGY AND ENERGY EXCHANGE IN TWO DESERT ARTHROPODS, Arizona State Univ., Tempe. Dept. of Zoology. For primary bibliographic entry see Field 02I. W71-01294

THE UNPRECEDENTED RAINS IN VIRGINIA ASSOCIATED WITH THE REMNANTS OF HURRICANE CAMILLE, Weather Bureau, Silver Spring, Md. Office of Hydrology. Francis K. Schwarz. Monthly Weather Review, Vol 98, No 11, p 851-859, November 1970. 9 p, 20 fig, 1 tab, 8 ref.

Descriptors: *Hurricanes, *Rainfall, *Synoptic analysis, *Probable maximum precipitation, *Virginia, Weather, Precipitation (Atmospheric), Floods, Disasters, Data collections, Isohyets, Meteorology, Rainfall disposition, Weather data. Identifiers: Hurricane Camille (1969).

The rainfall and synoptic features of the unprecedented Virginia storm associated with the remnants of hurricane Camille were analyzed. The rains of this storm are within 80 to 85 percent of the probable maximum precipitation for a duration of 12 hr for areas up to 1,000 sq mi. Persistent low-level moisture feeding into the remains of Camille's cyclonic circulation was close to the maximum persisting value for the season and location. The passage of the remnant low-pressure system a little to the south of the rain area resulted in low-level flow from the southeast which utilized the moisture, with some orographic intensification, without depletion by upwind barriers. In addition to the very high moisture values, a number of synoptic and mesoscale weather factors operated together to produce the remarkable rainfall. (K-napp-USGS) W71-01326

ARCTIC ICE AND SEA TEMPERATURE ANOMALIES IN THE NORTHEASTERN NORTH ATLANTIC AND THEIR SIGNIFICANCE FOR SEASONAL FORESHADOWING LOCALLY AND TO THE EASTWARD, Ocean-Atmosphere Research Inst., Cambridge, Mass. For primary bibliographic entry see Field 02C. W71-01332

ENVIRONMENTAL CHANGES AND THE ORIGIN OF AGRICULTURE IN THE NEAR EAST, Minnesota Univ., Minneapolis. Dept. of Geology. H. E. Wright, Jr. From a symposium 'Pleistocene Man-Environmental Relationships', held at Vllth Congress of the International Association for Quaternary Research (INQUA), Boulder, Colorado, 1965. BioScience, Vol 20, No 4, p 210-212, 217, 15 February 1970. 3 fig, 10 ref.

Descriptors: *Pleistocene epoch, *Environmental effects, *Paleoclimatology, *Agriculture, *Palynology, Temperature, Arid lands, Rainfall, Climatic data, On-site investigations, Domestic animals, Grains (Crops), Oak trees, History, Seeds, Ecosystems, Habitats, Ecology, Geologic time, Pollen, Dating. Identifiers: *Near East, *Agricultural origins, *Cultural origins, *Paleoecology, Life zones, Archaeology.

The 'oasis theory' of agricultural origins in the Near East postulates increasingly arid conditions at the end of the Pleistocene which forced man and animal together at scattered waterholes and

resulted in domestication. The theory is unsupported by detailed paleoecological studies or absolute dating measurements. Archaeological evidence from the Taurus-Zagros Mountain arc indicates a cultural sequence starting about 11,000 years ago when the inhabitants of the area were cave-dwelling hunters and gatherers. About 2,000 years later, they lived in permanent villages, cultivated grains and raised domestic animals. Pollen and seed diagrams furnish some evidence of a gradual warming of the area during that period, followed by reinvasion of oaks and seed grains (wild barley and emmer) from their Pleistocene refuges. The humans may have gradually realized the importance of the grains, leading to the development of agriculture. Detailed knowledge of rainfall and temperature changes in this period are lacking. (Casey-Arizona)
W71-01403

CONCERNING THE STRUCTURE OF PRECIPITATIONS. III. RAIN IN THE ARCTIC, TEMPERATE, AND TROPICAL ZONES, Sandia Corp., Albuquerque, N. Mex.

M. Diem.
Trans. from Arch. Meteorol. Geophys. Bioklimatol., Vol 16, 1968. Available from NTIS as SC-T-70-4006, \$3.00 in paper copy, \$0.95 in microfiche. Sandia Laboratories Translation, February 1970. 45 p, 21 ref.
Identifiers: *Rain, Raindrops, Intensity, Particle size, Radar reflections, Arctic regions, Tropical regions, Austria, Translations.

The structure of precipitation, which has been measured at eight stations distributed from the polar to the tropic zone, is mainly determined by the atmospheric stratification and by the geographical situation. Characteristic variations could be found at the different stations, which show up in the number of drops within the various classes of drop sizes or in the range of the spectrum. Rains caused by barrage or by lability are distinctly different. For Karlsruhe one can derive seasonal variations from the data collected in two years. Intense rains are combined with lability and high temperature and, therefore, are absent in the polar zone. Besides this, they appear only with broad spectra and are bound to large numbers of drops only in the tropics. Between an ideal rainfall and a really measured one there are always differences on account of the drops of different sizes which always appear (spectrum). From the observed structure of a rain one can derive its radar-reflectivity. Owing to the range of the spectrum it deviates largely from the reflectivity of the ideal rain, too, and differs from station to station. All this does not depend on whether one selects the mean drop diameter, the range of the spectrum, the water contents or the intensity of the rain as a parameter. Generally, the intensity of the observed rain is up to five times smaller than the intensity of the corresponding ideal rain. Finally, the durational progress of the single rains presents examples of the increase of the variation of all parameters with increasing intensity of the rain, and of the difficulty to predict correctly the intensity of the expected precipitation from radar observations.
W71-01521

ATMOSPHERIC MODELING, FIELD PROGRAMS, AND DECISION SYSTEMS, Rand Corp., Santa Monica, Calif.
F. W. Murray.
Available from NTIS as AD-702 672, \$3.00 in paper copy, \$0.95 in microfiche. Rept No P-4315, March 1970. 15 p, 3 fig, 9 ref.
Identifiers: *Artificial precipitation, *Atmosphere models, Atmospheric motion, Hydrodynamics, Clouds, Convection (Atmospheric), Mathematical models, Weather modification.

The interrelation between field programs and atmospheric modeling is discussed in the context of studies of weather modification. In particular, numerical models of convective clouds are considered. It is shown how activities in both field pro-

grams and modeling affect decisions concerning each other, culminating in the use of models for day-to-day 'go' and 'no go' decisions concerning the field programs. This talk was prepared for the Sixth Skywater Conference, sponsored by the Bureau of Reclamation in Denver, 10-11 February 1970.
W71-01535

2C. Snow, Ice, and Frost

DEEP CORE STUDIES OF THE CRYSTAL STRUCTURE AND FABRICS OF ANTARCTIC GLACIER ICE,

Cold Regions Research and Engineering Lab., Hanover, N.H.
Anthony J. Gow.
Available from NTIS as AD-704 348, \$3.00 in paper copy, \$0.95 in microfiche. February 1970. 20 p. Research Report 282.

Identifiers: *Crystal structure, Ice, *Ice, Antarctic regions, Glaciers, Sampling, Drilling, Crystal growth, Deformation, Structural properties, Melting, Thickness, Drill core analysis, Byrd Station (Antarctica), Little America 5 (Antarctica), Ross Ice Shelf, Ice fabrics.

Radical differences in the crystal structure and fabrics of glacier ice cores at Byrd Station and Little America V, Antarctica, are attributed to gross differences in the thermal and deformational histories of the ice at these two locations. At Byrd Station the mean size of crystals increased more than sixfold between 65 meters and the bottom of the drill hole at 309 meters. Crystal size was also found to increase linearly with the age of the ice, thus simulating isothermal grain growth in metals. However, this growth was not accompanied by any dimensional orientation of crystals or entrapped bubbles, or by any significant increase in the degree of preferred orientation of crystallographic c-axes. These observations imply that negligible shearing is occurring in the top 300 meters of the thick grounded ice sheet at Byrd Station. By contrast very considerable deformation is indicated for the floating 258-m-thick Ross Ice Shelf at Little America. This deformation is characterized by the widespread occurrence of 'strained' crystals below 65 meters, the existence of elongated oriented bubbles between 95 meters and 130 meters and the attainment of pronounced crystal orientation (multiple-maxima fabrics) by 100-meters depth. Exaggerated growth of crystals below 150 meters is attributed to increasing temperatures in the ice shelf. The crystal structure of these cores clearly demonstrates that glacial ice only is present in the Ross Ice Shelf at Little America V.
W71-01159

INVESTIGATION OF AIRFIELD DRAINAGE, ARCTIC AND SUBARCTIC REGIONS, PART I. FIELD RECONNAISSANCE AND ANALYSIS, Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 04A.
W71-01176

INVESTIGATION OF AIRFIELD DRAINAGE, ARCTIC AND SUBARCTIC REGIONS, PART II. TRANSLATIONS OF SELECTED TOPICS, Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 04A.
W71-01177

ARCTIC ICE AND SEA TEMPERATURE ANOMALIES IN THE NORTHEASTERN NORTH ATLANTIC AND THEIR SIGNIFICANCE FOR SEASONAL FORESHADOWING LOCALLY AND TO THE EASTWARD, Ocean-Atmosphere Research Inst., Cambridge, Mass.
I. I. Schell.

Monthly Weather Review, Vol 98, No 11, p 833-850, November 1970. 18 p, 37 fig, 5 tab, 46 ref. NSF Grant GA-1264.

Descriptors: *Water temperature, *Sea ice, *Arctic, *Weather forecasting, Precipitation (Atmospheric), Synoptic analysis, Weather patterns, Atlantic Ocean, Meteorology.
Identifiers: Arctic ice limit.

A 6-yr period with an extreme northerly ice limit and relatively high sea temperatures in the North Atlantic and another 6-yr with an extreme southerly ice limit and relatively low sea temperatures during April-September were compared to find the effects of sea temperature anomalies on the contemporary and subsequent October-March air temperatures and precipitation locally and to the eastward. A relationship was found with the contemporary and the subsequent cold season temperature and precipitation progressively later in Iceland, Europe, the Middle East, northern Pakistan, and India, in keeping with the general movement of weather systems from west to east in the middle and high latitudes. A basis for estimating the cold season temperature and precipitation in the northeastern North Atlantic, Europe, the Middle East, northern Pakistan, and India may become available early in October. (Knapp-USGS)
W71-01332

ELECTRICAL PROPERTIES OF SALINE ICE,

McGill Univ., Montreal (Quebec). Dept. of Physics.
J. R. Addison.
Available from NTIS as AD-704 269, \$3.00 in paper copy, \$0.95 in microfiche. See also AD-704 268 and AD-434 346. Journal of Applied Physics, Vol 40, No 8, p 3105-3114, July 1969. 11 fig, 39 ref.
Identifiers: *Sea ice, Electrical properties, Salinity, Dielectric properties, Temperature, Impurities, Canada, Remote areas.

Results are presented of a study of the (Normalized) complex dielectric coefficient and related parameters, of unidirectionally frozen artificial sea ice having salinities from 4 to 20%. The frequency dispersion was investigated between 20 Hz and 100 MHz at temperatures from minus 35 to minus 12.5°C. An unusual measurement cell, which becomes incorporated into the ice as it forms, is described and justification offered for its use. The electrical properties changed most rapidly with temperatures near minus 23°C, the NaCl deposition temperature. (See also W71-01533)
W71-01532

THE ELECTRICAL PROPERTIES OF SALINE ICE,

McGill Univ., Montreal (Quebec). Dept. of Physics.
J. R. Addison, and E. R. Pounder.
Available from NTIS as AD-704 268, \$3.00 in paper copy, \$0.95 in microfiche. Physics of Snow and Ice, Proceedings of the International Conference on Low Temperature Science, 1966, Vol 1, Pt 1, 1967, p 649-660. 9 fig, 27 ref. Contract Nonr-4417 (00).
Identifiers: *Sea ice, Electrical properties, Salinity, Resistance (Electrical), Impurities, Dielectric properties, Symposia, Canada, Remote areas.

Results of a current study of the (normalized) dielectric coefficient and the equivalent parallel resistivity of unidirectionally frozen saline ice are given. Frequencies ranged from 20 Hz to 100 MHz. Salinities were of the order 7-20 p.p.t. A detailed study of frequency dependence was carried out at minus 22°C. Resistivities ranged from 10 to 1000 ohm-meters, decreasing slowly with increase in frequency. The effect of variation of temperature was also studied. A cell, with metalized nylon mesh electrodes, which become incorporated into the ice as it grows, is described, along with experimental justification for its use. (See also W71-01532)
W71-01533

Field 02—WATER CYCLE

Group 2D—Evaporation and Transpiration

2D. Evaporation and Transpiration

EVAPORATION FROM SNOW AND EVAPORATION RETARDATION BY MONOMOLECULAR FILMS. A REVIEW OF LITERATURE, Cold Regions Research and Engineering Lab., Hanover, N.H.
For primary bibliographic entry see Field 03B.
W71-01143

THE DETERMINATION OF SUITABLE AVERAGE VALUES OF METEOROLOGICAL DATA FOR USE IN ESTIMATION OF EVAPOTRANSPIRATION, North Dakota Water Resources Research Inst., Fargo.

John C. Hudson, Joseph R. Schwendeman, and Duane L. Younggren.
Available from NTIS as PB-195 665, \$3.00 in paper copy, \$0.95 in microfiche. Research Project Technical Completion Report, WI-221-008-70, North Dakota Water Resources Research Institute, June 1970. 16 p, 3 tab, 2 fig, 21 ref. OWRR Project A-008-NDAK (1).

Descriptors: *Evapotranspiration, *Micrometeorology, *Evaporation, Humidity, Solar radiation, Soil temperature, *Water loss, North Dakota, Meteorology.

A quantitative analysis of evapotranspiration was carried out at the University of North Dakota Meteorological Station. From data collected on a daily basis during the summer of 1967, several linear regression models predicting evapotranspiration were derived. The variables used in the study were actual evapotranspiration (dependent), air temperature, relative humidity, air movement, water loss from an open pan, and soil temperature (independent). The model providing the best fit yielded a multiple correlation coefficient of $R = .49321$. A simplified predictive equation for evapotranspiration was obtained, using only pan loss and soil temperature as independent variables. In this case, $R = .45792$, indicating little loss in prediction. The single variable correlating most highly with evapotranspiration was maximum air temperature, for which $R = .4291$. These values are interpreted as surrogates for actual evapotranspiration information. Better prediction was achieved in the case of estimating water loss from an open pan. Using relative humidity, total air movement, maximum air temperature, and soil temperature as independent variables, a multiple correlation, $R = .78954$, was obtained.
W71-01190

THE EFFECTS OF SURFACE PROPERTIES OF WATER ON EVAPORATION AND CONDENSATION,

Rochester Inst. of Tech., N.Y.
For primary bibliographic entry see Field 02K.
W71-01198

EVAPORATIVE WATER LOSS FROM THE DESERT IGUANA, DIPLOSOSAURUS DORSALIS, Michigan Univ., Ann Arbor. Dept. of Zoology. John E. Minnich.
National Science Foundation Grant GB-6230. Copeia, No 3, p 575-578, 3 September 1970. 1 fig, 14 ref.

Descriptors: *Xerophilic animals, *Reptiles, *Evaporation, *Moisture deficit, *Weight, Laboratory tests, Arid lands, Animal physiology, Vapor pressure, Humidity, Water loss, Temperature, Animal metabolism, Permeability, Burrows, Moisture deficit, Physiological ecology.
Identifiers: *Desert Iguana, *Body weight, *Body surface area, *Relative humidity, *Integument, Skin sloughing, Fossorial animals, Saturation deficit.

Above ground on a summer day, at 42 degrees C. and 15 mm Hg vapor pressure, the desert iguana is subjected to a moisture saturation deficit (SD) of

45.5 mm Hg. At night, in a burrow of 12 in. depth and a temperature of 39 degrees C., the SD is 22.8 mm Hg. Measurements of evaporative water loss were performed under these conditions in a controlled laboratory environment. With resting animals the slope of a log-log curve of evaporative water loss vs. body weight was very close to -0.33 , suggesting that evaporative water loss is related to body surface area. Water loss rates increase 2-to 5-fold in active animals and also increase during skin shedding which is likely due to a transient increase in skin permeability. Oxidative water production at low humidities seems insignificant. During activity under these conditions, adult animals lost 0.86% of their body weight/day through evaporation, which represents about 28% of their daily water turnover in nature. (Casey-Arizona)
W71-01290

HYGROSCOPIC ADDITIVES TO PHENOXY HERBICIDES FOR CONTROL OF SALT- CEDAR, Agricultural Research Service, Los Lunas, N. Mex. Crops Research Div.
For primary bibliographic entry see Field 03B.
W71-01405

2E. Streamflow and Runoff

THE OCCURRENCE AND GEOLOGIC WORK OF RIP CURRENTS OFF SOUTHERN CALIFORNIA, University of Southern California, Los Angeles. Dept. of Geological Sciences.
For primary bibliographic entry see Field 02J.
W71-01102

A RECONNAISSANCE OF THE WATER RESOURCES IN THE PORTNEUF RIVER BASIN, IDAHO, Geological Survey, Boise, Idaho. R. F. Norvitch, and A. L. Larson.
Idaho Department of Reclamation Water Information Bulletin No 16, June 1970. 58 p, 18 fig, 5 tab, 37 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, Idaho, Topography, Climatic data, Drainage, Geologic formations, Hydrogeology, Aquifer characteristics, Springs, Wells, Water levels, Streamflow, Runoff, Floods, Discharge measurement, Water quality, Irrigation, Water supply, Industries, Municipal water, Hydrographs.
Identifiers: Landforms, Upper valley drainage, Lower valley drainage.

The part of the Portneuf River basin described includes an area of about 1,160 square miles in southeastern Idaho. It lies on the Columbia River side of the divide between the Columbia River basin and the Great Basin drainages. Hydrologic data collected during the reconnaissance are illustrated and discussed. Hydrologic problems that have resulted from use of the water resources are pointed out, and the scope required of some future project aimed at describing more fully the water resources of the basin is presented. The work accomplished during this reconnaissance, made in the period July 1968 to June 1969, consisted of (1) a partial inventory of water wells in the basin; (2) establishment of new stream-gaging sites and groundwater observation wells; (3) geologic and hydrologic mapping; (4) mapping of areas irrigated with groundwater; (5) an evaluation of the use of ground and surface water for irrigation; (6) an evaluation of the interrelation between surface and groundwater; (7) a generalized appraisal of the chemical quality of the water resources; and (8) an evaluation of the need for and the possible methods that could be used to make a comprehensive quantitative study of the water resources of the basin. (Woodard-USGS)
W71-01104

UNSTEADY FREE-SURFACE FLOW COMPUTATIONS, Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-01108

INDETERMINATE HYDRAULICS OF ALLUVIAL CHANNELS, Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 02J.
W71-01110

ALLUVIAL RIVER BEHAVIOR - A FEW ASPECTS OF ITS SIMULATION IN A MODEL, For primary bibliographic entry see Field 08B.
W71-01211

COMPUTER SIMULATION OF RIVERBED DEGRADATION AND AGGRADATION BY THE METHOD OF CHARACTERISTICS, South Dakota State Univ., Brookings.

Fred F. M. Chang.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 337-344, 1969. 8 p, 1 fig, 8 ref.

Descriptors: *Simulation analysis, *Mathematical models, *Sediment transport, *Alluvial channels, *Aggradation, Degradation (Stream), Erosion, Deposition (Sediments), Bed load, Mathematical studies, Computer programs.
Identifiers: Method of characteristics.

For unsteady flow in alluvial channels, three characteristic equations can be derived from three basic equations. However, this introduces many computational difficulties, and only a graphic solution has been developed. In order to avoid these difficulties, two characteristic equations are derived from three basic equations. By assuming that the deposit of sediment is uniformly distributed in a short reach, three basic equations are successfully reduced to two basic equations and then, from them, the two characteristic equations are derived. The computing procedures are divided into two parts: (a) to compute the average velocity and the depth of sediment-laden flow by two characteristic equations, and then, (b) to estimate the deposition of sediment by using the continuity equation of sediment. (Knapp-USGS)
W71-01212

DATA-REVERSIBLE SYSTEMS FOR FLOOD ROUTING, Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 06A.
W71-01213

SIMULATION TECHNIQUES IN WATER RESOURCES SYSTEMS, State Hydraulic Works, (Turkey). Dept. of Research. Sahap Aksoy.
French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 221-230, 1969. 10 p, 4 fig, 2 ref.

Descriptors: *Hydraulic models, *Hydraulic similitude, *Sediment transport, *Alluvial channels, Mathematical studies, Flumes, Closed conduit flow, Open channel flow.
Identifiers: Pressure models (Hydraulic).

The design and some similarity analyses of pressure models suitable for investigation of movable-bed river problems are discussed. The similarity conditions are introduced by analyzing the fundamental equations of flow and sediment transportation. By

movable bed models along it is usually impossible to meet all similarity requirements. The scale-effects for flow and solid material transport may be corrected by the given methods. (Knapp-USGS)
W71-01215

ELECTRONIC ANALOGUES REPRESENTING NONLINEAR FLOW THROUGH OPEN CHANNELS AND FLOOD CONTROL STRUCTURES, Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 08B.
W71-01217

ACCURACY OF THE NUMERICAL SOLUTION FOR GENERAL UNSTEADY RIVER FLOW EQUATION, Takeshi Ito, Hiroshi Fujii, and Sumihisa Ohira. French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 429-437, 1969. 9 p, 3 fig, 3 ref.

Descriptors: *Unsteady flow, *Routing, *Water storage, Flood forecasting, Streamflow, Discharge (Water), Equations, Mathematical studies, Stage-discharge relations.

In this paper a scheme is described for the digital computation of discharges and water levels in rivers when the flow is unsteady. The results of calculation prove that the conservation law of water is realized; that is, the difference between inflow and outflow is storage in calculated sections of streams. (Knapp-USGS)
W71-01223

A MATHEMATICAL MODEL OF UNSTEADY FLOW IN A NATURAL OR ARTIFICIAL WATER COURSE, Vattenbyggnadsbyran, Stockholm (Sweden). Lennart Rundgren. French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 511-518, 1969. 8 p, 4 fig, 1 ref.

Descriptors: *Unsteady flow, *Open channel flow, *Mathematical models, Regulation, Flood control, Stage-discharge relations, Channel morphology, Computer programs, Water storage, Reservoir operation, Hydrologic budget.

A model is developed for the calculation of the water level and the water flow in any part of a natural river or other water course as a function of time. The model facilitates the estimate of the backwater effect of a dam or other obstacles placed in the water course with due regard to variations in inflow, evaporation losses and rainfall. The model is especially useful for the estimation of flow variations along a river where the discharge is being regulated. (Knapp-USGS)
W71-01224

AMPLITUDE-DISSIPATIVE AND PHASE-DISSIPATIVE SCHEMES FOR HYDRAULIC JUMP STIMULATION, Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 08B.
W71-01225

THE CALCULATION OF FLOOD HYDROGRAPHS IN SOME RIVER SYSTEMS IN GERMANY, Technische Hochschule, Brunswick (West Germany). Friedrich Zimmermann, and Ulrich Maniak. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan,

August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 379-383, 1969. 5 p, 2 fig.

Descriptors: *Mathematical models, *Hydrograph analysis, *Flood routing, Flood forecasting, Routing, Model studies, Regulation, Flood control, Water management (Applied).
Identifiers: Germany.

A mathematical model is used for investigations of the Aller-River-System in Northern Germany with a catchment area of some 16,000 sq km and a total length of the water courses investigated of approximately 500 km. The river near its confluence with the Weser River has an average discharge of 110 cu m/sec and maximum flood of 1500 cu m/sec. The mathematical model covers floodwater discharges in the Aller River and its major tributaries the Oker, Innerste and Leine Rivers. The first inflow hydrograph is identical with an observed hydrograph at a watergauge in the beginning of the reach investigated. At every water gage in the intermediate reach the calculation is compared with the observed hydrograph. To fit the calculated hydrograph to the computed hydrograph it is necessary to introduce correction coefficients. (Knapp-USGS)
W71-01226

MATHEMATICAL MODELLING ON DIGITAL COMPUTERS AND CALCULATIONS FOR MULTI-PURPOSE UTILIZATION OF STREAM-FLOW, For primary bibliographic entry see Field 06A.
W71-01228

THE ANALYSIS OF UNSTEADY FLOW IN RIVERS BY AN ANALOGUE COMPUTER, Public Works Research Inst. Tokyo (Japan).
For primary bibliographic entry see Field 07C.
W71-01230

A NEW RATIONAL METHOD FOR CALCULATION OF MAXIMUM FLOOD DISCHARGE BY AMOUNT OF RAINFALL IN THE CATCHMENT, Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering. Tae Sang Won. French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 133-143, 1969. 11 p, 6 fig, 1 ref.

Descriptors: *Flood forecasting, *Rational formula, *Peak discharge, *Rainfall-runoff relationships, Precipitation intensity, Watersheds (Basins), Equations, Runoff forecasting, Flood control, Water management (Applied), Hydrograph analysis.
Identifiers: Isochron methods.

An extension of the rational method was developed for calculation of maximum river flood discharge with variable intensity of rainfall. A reasonable method of division of a complicated drainage basin which consists of numerous tributaries into isochronic zones is suggested. This method of calculation of flood discharge is applicable for the design of sewers and river improvement works. (Knapp-USGS)
W71-01234

INDIRECT DETERMINATION OF SYNTHETIC RUNOFF, Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div.
For primary bibliographic entry see Field 02A.
W71-01235

METHODS OF CALCULATING STEADY AND UNSTEADY CURRENTS IN HOMOGENEOUS LAKES, Cornell Univ., Ithaca, N.Y.
For primary bibliographic entry see Field 02H.
W71-01244

FLOW PATTERN OF DENSITY CURRENT AT A RIVER MOUTH, Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering. Masakazu Kashiwamura, and Shizuo Yoshida. French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 181-190, 1969. 10 p, 14 fig, 6 ref.

Descriptors: *Density currents, *Saline water-freshwater interfaces, Streamflow, Density stratification, Stratified flow, Oceans, Estuaries, Saline water intrusion, Hydraulic models, Mixing, Dispersion, Turbulence, Turbulent flow.
Identifiers: Mixing patterns (river water-sea water).

Flow patterns of fresh streams entering salt water are classified through experiments into five patterns, from A to E. The A pattern flow has the character of a density current and its stream lines are stable without turbulence. The E pattern flow resembles a plane jet of a single fluid, which grows with turbulence and secondary currents. Other patterns, B, C, and D, are transitional between those two. Distributions of velocity and specified gravity are also discussed for every pattern, and experimental results and field observations are illustrated and compared. (Knapp-USGS)
W71-01255

FLOW DISTRIBUTION IN STREET INTERSECTIONS AS DETERMINED BY EXPERIMENTAL HYDRAULIC MODEL STUDIES, Los Angeles Bureau of Engineering, Calif. Storm Drain Div.

City of Los Angeles Bureau of Engineering, Storm Drain Design Division, Los Angeles, California, 1952-1953. 63 p, 59 fig.

Descriptors: *Flow rates, *Flow measurement, *Water measurement, *Drainage systems, *Hydraulics, *Open channel flow, *Drainage engineering, *Drainage practices, *Model studies, *Road design, Urbanization, Hydraulic models, Hydraulic engineering, Drainage water, California.
Identifiers: *Street intersections, *Street drainage, *Urban drainage, Experimental models, Los Angeles (Calif).

The publication is an assembly of 59 different sets of charts which can be used in designing urban streets and drainage systems. The charts were developed for determining storm runoff flow distribution in right-angle street intersections. Each chart reflects predetermined prototype inflow quantities of water which may reach a right angle cross-street intersection from two directions under varying conditions of street widths, slopes, crowns, and crossfalls. Based upon a given set of conditions, the distribution of the combined inflow can be determined at the street intersection as it emerges from the intersection, in the two outflow street sections. These calculated quantities can then be used in the design of street stormwater inlets, catch basins and storm sewers. The charts were developed from experimental hydraulic model studies conducted by the City of Los Angeles over a 16 month period. The models were built to a 1:15 scale. Much of the data was developed from an adjustable model, in which the significant physical parameters could be varied to simulate prototype conditions worthy of study. Initially, the work was jointly sponsored by the California State Division of Highways and the City of Los Angeles. The City later continued and expanded the studies to result in the subject publication. (Poertner)
W71-01334

Field 02—WATER CYCLE

Group 2E—Streamflow and Runoff

SOME EFFECTS OF URBANIZATION ON FLOODS,
Illinois State Water Survey, Urbana.
For primary bibliographic entry see Field 04C.
W71-01336

A NUMERICAL DETERMINATION OF SALT WEDGE MOVEMENTS,
F. Boulot, and P. Braconnot.
Houille Blanche, No 8, p 871-877, 1967. Transl from Fr, TT 70-58139, 1970. 15 p, 10 fig, 8 ref.

Descriptors: *Numerical analysis, Sea water, *Sea water intrusion, Rivers, *Estuaries, Interfaces, Unsteady flow, Differential equations, Equations, Foreign research, Streamflow, Movement, Finite differences, Boundaries (Surfaces), Mathematical analysis, Characteristics, *Saline water-freshwater interfaces, *Saline water, Hydrology, Hydraulics. Identifiers: Salt front, France, Boundary conditions, Saline-nonsaline interfaces.

Salt water wedges are likely to form in river estuaries under certain flow conditions and eventually extend several kilometers upstream. Where the riverbed is fairly even and the tide not strong enough for total flow reversals to take place, and when no sudden discharge variations occur, there is little exchange between the 2 layers and an interface can be assumed to exist. Slight exchange does take place frequently, and the interface can be defined as the locus of points at which the fluid density is the mean of the 2 layers. The problem of salt water movement in river estuaries is one of unsteady flow of 2 liquids of different densities with a free surface and an interface. Equations assuming gradually varying flows lead to a system of 4 partial differential equations in terms of time and abscissa calculated along the stream. A numerical resolution of this differential system is presented. (USBR)
W71-01389

ST LOUIS SAN FRANCISCO RY V MANNING (RAILROAD'S LIABILITY FOR DESTROYING NATURAL PROTECTION FROM RIVER OVERFLOW).
For primary bibliographic entry see Field 06E.
W71-01519

STREAM CATALOG OF SOUTHEASTERN ALASKA REGULATORY DISTRICT NOS. 14 and 15.
Alaska Dept. of Fish and Game, Juneau.

Available from NTIS as PB-191 160, \$3.00 in paper copy, \$0.95 in microfiche. U.S. Fish and Wildlife Service Data Report 45, February 1970. 208 p. Contract DI-14-17-0005-24.
Identifiers: *Rivers, *Catalogs, *Fishes, Alaska, *Alaska, Rivers, Law, Geography, Classification, Weather, Temperature, Surveying, Airborne, Reproduction (Physiology), Site selection, Indexes, Maps, Fisheries, Spawning, *Salmon streams, *Stream catalog, Remote areas.

Information about part of Southeastern Alaska salmon streams is cataloged from the voluminous records of the Alaska Department of Fish and Game; the Alaska Salmon Industry; the Fisheries Research Institute of the University of Washington; the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries; and other agencies. Stream descriptions, maps, and historical records of salmon escapement data are compiled for 69 salmon streams in Southeastern Alaska Regulatory Districts 14 and 15. Each stream is located geographically by latitude and longitude and by orientation to prominent landmasses. A standard numbering system, number designations formerly in use, and common names of streams are listed. Physical descriptions are presented for the intertidal zone and the upstream areas of each stream. Available records of weather, water temperatures, and information useful to ground and aerial stream surveyors are presented in brief form. The species of salmon using the spawning grounds and estimates

of the escapements each year for many years are given. (See also W71-01542 and W71-01543).
W71-01541

STREAM CATALOG OF SOUTHEASTERN ALASKA REGULATORY DISTRICT NO. 12.
Alaska Dept. of Fish and Game, Juneau.

Available from NTIS as PB-191 161, \$3.00 in paper copy, \$0.95 in microfiche. US Fish and Wildlife Service Data Report 46, March 1970. 222 p. Contract DI-14-17-0005-24.
Identifiers: *Rivers, *Catalogs, *Fishes, Alaska, *Alaska, Rivers, Law, Geography, Classification, Weather, Temperature, Surveying, Airborne, Reproduction (Physiology), Site selection, Indexes, Maps, Fisheries, Spawning, *Salmon streams, *Stream catalogs, Remote areas.

Information about part of Southeastern Alaska salmon streams is cataloged from the voluminous records of the Alaska Department of Fish and Game; the Alaska Salmon Industry; the Fisheries Research Institute of the University of Washington; the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries; and other agencies. Stream descriptions, maps, and historical records of salmon escapement data are compiled for 58 salmon streams in Southeastern Alaska Regulatory District 12. Each stream is located geographically by latitude and longitude and by orientation to prominent landmasses. A standard numbering system, number designations formerly in use, and common names of streams are listed. Physical descriptions are presented for the intertidal zone and the upstream areas of each stream. Available records of weather, water temperatures, and information useful to ground and aerial stream surveyors are presented in brief form. The species of salmon using the spawning grounds and estimates of the escapements each year for many years are given. (See also W71-01541 and W71-01543).
W71-01542

STREAM CATALOG OF SOUTHEASTERN ALASKA REGULATORY DISTRICTS NOS. 10 and 11.
Alaska Dept. of Fish and Game, Juneau.

Available from NTIS as PB-191 159, \$3.00 in paper copy, \$0.95 in microfiche. US Fish and Wildlife Service Data Report 44, February 1970. 267 p. Contract DI-14-17-0005-24.
Identifiers: *Rivers, *Catalogs, *Fishes, Alaska, *Alaska, Rivers, Law, Geography, Classification, Weather, Temperature, Surveying, Airborne, Reproduction (Physiology), Site selection, Indexes, Maps, Fisheries, Spawning, *Salmon streams, *Stream catalogs, Remote areas.

Information about part of Southeastern Alaska salmon streams is cataloged from the voluminous records of the Alaska Department of Fish and Game; the Alaska Salmon Industry; the Fisheries Research Institute of the University of Washington; the U.S. Fish and Wildlife Service, Bureau of Commercial Fisheries; and other agencies. Stream descriptions, maps, and historical records of salmon escapement data are compiled for 71 salmon streams in Southeastern Alaska Regulatory Districts 10 and 11. Each stream is located geographically by latitude and longitude and by orientation to prominent landmasses. A standard numbering system, number designations formerly in use, and common names of streams are listed. Physical descriptions are presented for the intertidal zone and the upstream area of each stream. Available records of weather, water temperatures, and information useful to ground and aerial stream surveyors are presented in brief form. The species of salmon using the spawning grounds and estimates of the escapements each year for many years are given. (See also W71-01541 and W71-01542).
W71-01543

LEITCH V SANITARY DIST OF CHICAGO (RIPARIAN RIGHT TO UNOBSTRUCTED FLOW OF RIVER).
For primary bibliographic entry see Field 06E.
W71-01577

2F. Groundwater

CARBON-14 AGES RELATED TO OCCURRENCE OF SALT WATER,
Geological Survey, Washington, D.C.
For primary bibliographic entry see Field 02L.
W71-01107

VARIATIONAL APPROACH TO NON-DARCY FLOW,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 08B.
W71-01109

THE USE OF LINEAR PROGRAMMING FOR ESTIMATING GEOHYDROLOGICAL PARAMETERS OF GROUNDWATER BASINS,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
David Kleinecke.
Available from NTIS as PB-195 668, \$3.00 in paper copy, \$0.95 in microfiche. TEMP Report 70TMP-43, July 1970. 31 p, 1 tab, 8 ref. OWRR Project C-1339 (No 1971) (1).

Descriptors: *Aquifer characteristics, *Computer models, Data collections, Groundwater movement, *Groundwater basins, *Hydrogeology, *Linear programming, *Mathematical models, Model studies, *Simulation analysis.

Simulation models of groundwater basins require estimates of geohydrological parameters such as permeability and storage capacity. In present practice these parameters are initially guessed at and later adjusted by trial and error to improve the model's ability to simulate some known portion of the water history. It has been suggested that this process might be reversed to deduce geohydrology directly from the historical record. This suggestion was tested against a basin studied earlier by the California State Department of Water Resources. The fitting criteria used gave rise to linear programming formulations which were solved from the basin data. The approach shows promise in that about one-third of the basin parameters were evaluated, but further development is required. It is believed that historical records, although apparently overdetermining the system of equations, actually underdetermine the system because of redundancy effects. The approach appears to offer the best known method for estimating the effective aquifer depth. (See also W71-01194)
W71-01193

USING EXPERIMENTAL MODELS TO GUIDE DATA GATHERING,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
Charles F. Meyer.
Available from NTIS as PB-195 669, \$3.00 in paper copy, \$0.95 in microfiche. TEMPO Report 70TMP-49, July 1970. 34 p, 4 fig, 1 tab, 28 ref. OWRR Project C-1339 (No 1971) (2).

Descriptors: *Aquifer characteristics, *Computer models, *Data collection, *Groundwater movement, Groundwater basins, Hydrogeology, Linear programming, *Mathematical models, Model studies, Monte Carlo method, Optimization, Project planning, *Simulation analysis, Water management.

In constructing a plausible mathematical model of a groundwater basin, including the flow equations and the data describing the physical parameters of the basin, use of a series of experimental models

may be found to be the minimal-cost approach to guiding data-gathering programs while simultaneously developing a plausible model to be used for predicting the consequences of management decisions such as increasing or decreasing the amount of water to be withdrawn in various parts of the basin. The basis for experimentation is a sensitivity analysis, for which triangular and log-triangular distributions are suggested as appropriate methods for perturbing known values of parameters into 'erroneous' values. The worth of improving the accuracy of measurements or estimates can be evaluated empirically by use of these techniques. Automated techniques for deducing basin parameters from histories of water levels were developed but were not fully successful. Use of linear programming shows some promise but requires further development before being routinely applicable. (See also W71-01193)
W71-01194

GROUND WATER QUALITY IN STANLY COUNTY, NORTH CAROLINA,
North Carolina State Dept. of Water and Air Resources, Raleigh.
Edward L. Berry.
North Carolina, Department of Water Resources
Ground Water Circular No 15, August 1970. 24 p, 8 fig, 3 tab, 8 ref.

Descriptors: *Groundwater, *Water quality, *Chemical analysis, Data collections, Water sources, Water pollution, Hydrology, Water table, Bacteria, Coliforms, Water wells, Logging (Recording), Groundwater basins, Surface waters, Infiltration, North Carolina.
Identifiers: Stanly County (North Carolina).

Groundwater was studied to ascertain the existence, source, and extent of any bacteriological pollution which might be detrimental to the environmental health of Stanly County, North Carolina residents. Chemical and physical analyses of water and well data from this study and previous studies show that groundwater of suitable quantity and quality for domestic and other water needs is available throughout Stanly County. The groundwater supply of the County is not polluted. Pollution of individual wells has occurred as a result of poor construction and improper finishing of wells. Poorly constructed and finished wells are numerous in the county. There is no evidence that the Rocky and Yadkin Rivers are a source of groundwater pollution. Data concerning topography, geology, geophysical logs, water tables, well-numbering grid system, and water analyses are shown. (Woodard-USGS)
W71-01203

AN ANALYSIS OF RUNOFF MODELS,
Nagoya Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02A.
W71-01232

MATHEMATICAL MODEL OF THE BIG BEND WELL FIELD,
Southwestern Ohio Water Co., Cincinnati; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.
Robert C. Lewis, and Louis M. Laushey.
French summary included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 503-509, 1969. 7 p, 1 fig, 2 tab, 1 ref.

Descriptors: *Water levels, *Withdrawal, *Aquifers, *Ohio, *Mathematical models, Data collections, Data processing, Optimization, Systems analysis, Water level fluctuations, Water levels, Water wells, Water yield, Hydrologic data, Hydrogeology.
Identifiers: Big Bend Well Field (Ohio).

Continuous withdrawals of substantial quantities of groundwater have been made from the Big Bend

area of the Great Miami River aquifer in southwestern Ohio since 1952. Extensive data have been collected since 1952 on groundwater levels, influent surface stream elevations, and metered quantities of water pumped from the well field. A mathematical model was developed to correlate groundwater withdrawal, rainfall infiltration, and river recharge with changes in storage in the aquifer between 1959 and 1968. An electrical analog model of convenient scale was constructed to simulate the performance of the well field under various conditions of recharge and discharge. The mathematical model is used to calculate the maximum safe yield for the Big Bend well field for the maximum utilization of the aquifer. (Knapp-USGS)
W71-01236

SPECIAL CASES OF WATER SUPPLY INTERFERENCE CAUSED BY URBAN DEVELOPMENT NEAR TORONTO, ONTARIO, CANADA,
Ontario Water Resources Commission, Toronto.
Donald N. Jeff, and Jaak Viirland.
Water Resources Bulletin, Vol 6, No 5, October 1970, p 746-753. 4 fig, 4 ref.

Descriptors: *Water supply, *Urbanization, Wells, Cities, Surface waters, Groundwater, Surface-groundwater relationships.
Identifiers: *Water supply interference, *Urban development.

Since 1961, control over water-supply interference problems in the Province of Ontario has been provided under the Ontario Water Resources Commission Act. A section of the act requires persons taking more than 10,000 imperial gallons per day of water for purposes other than domestic, stock or fire-fighting to have a permit and to take the water in accordance with specified terms and conditions. In cases of serious interference, the Commission has required that steps be taken to restore water supplies or prevent continued interference. Construction of some new wells, sewers, and roads to meet the needs of urban development has caused interference with both ground- and surface-water supplies. Two cases are described where municipalities in the Toronto area restored supplies to overcome serious interference with several private wells and streamflow during testing and operation of a 500 imperial gpm municipal well adjacent to a normally effluent stream, and varying degrees of interference with private wells caused by dewatering at rates up to 2000 imperial gpm from the installation of a trunk sewer. (Davis-Chicago)
W71-01363

NUMERICAL SOLUTION OF THE BOUSSINESQ EQUATION FOR AQUIFER-STREAM INTERACTION,
Stanford Univ., Calif.
George M. Hornberger, Janet Ebert, and Irwin Remson.
Water Resources Research, Vol 6, No 2, p 601-608, Apr 1970. 8 p, 9 fig, 23 ref.

Descriptors: *Numerical analysis, Aquifers, Streams, *Groundwater flow, Groundwater movement, Base flow, Streamflow, Mathematical models, Mathematical analysis, Finite differences, Analogs, Hydrology, Flood waves, Hydrograph analysis, Groundwater, Water level fluctuations, Bibliographies.
Identifiers: *Boussinesq equation, Comparative studies, Porous media flow, Finite difference method, Groundwater hydrology.

An efficient numerical technique is used to obtain solutions of the Boussinesq equation for problems of groundwater recession and groundwater flow in response to changes in stream stage. Comparison of the numerical results with the analytical solution of Boussinesq attests to the accuracy of the former. Solving a recession problem indicates that the form of the Werner and Sundquist model of groundwater discharge recession is appropriate. Solving a problem involving changing boundary conditions on an aquifer because of a flood wave provides data

relative to groundwater outflow. A comparison with the results of Cooper and Rorabaugh evaluates the applicability of a linear model of unconfined flow. (USBR)
W71-01379

2G. Water in Soils

A SEMI-QUANTITATIVE HYDROLOGICAL CLASSIFICATION OF SOILS IN NORTH-EAST ENGLAND,
Newcastle-upon-Tyne Univ. (England). Dept. of Civil Engineering.
D. T. Edmonds, R. B. Painter, and G. D. Ashley.
Journal of Soil Science, Vol 21, No 2, p 256-264, September 1970. 9 p, 1 fig, 1 tab, 3 ref.

Descriptors: *Rainfall-runoff relationships, *Infiltration, *Permeability, *Soil water movement, *Soil classifications, Subsurface runoff, Open channel flow, Hydrograph analysis, Base flow, Floods, Peak discharge, Depth-area-duration analysis, Flood routing.
Identifiers: England, Flood-wave formation.

Multiple regression equations relating the times-to-peak of flood hydrographs on 26 rivers in NE. England with the characteristics of causative rainfall and those of the relevant river basin, showed flood-wave formation to be largely dependent on storm duration and the average minimum infiltration rate of the soil. Other significant factors were the initial flow in the river, temporal variation of rainfall during a storm, and main river channel length and slope. A semi-quantitative hydrological classification was made of the soils in Northumberland, Durham, and Yorkshire, together with parts of Lancashire, Cumberland, and Westmorland, based on a ranking of their probable minimum infiltration rates. (Knapp-USGS)
W71-01106

WET STRENGTH OF SILICA-DILUTED SYNTHETIC SOIL AGGREGATES,
Minnesota Univ., Minneapolis. Dept. of Soil Science.
Chyi-sheng Hwang.
M.S. Thesis, Minnesota University Graduate School, October 1969. 48 p, 12 fig, 9 tab, 38 ref.
OWRR Project No B-015-MINN (2).

Descriptors: *Soil aggregates, *Cement grouting, *Soil sealants, Wetting, Silica, Quartz, Soil cement, Clay loam, Silts, Silicates, Bonding, Oxidation, Soil moisture, Infiltration, Crop production, Soil management.
Identifiers: *Experimental soils, Silicic acid, Moisture retention, Synthetic soil aggregates, Glassbeads.

The cementing effect of silica incorporated into synthetic soil aggregates were investigated. Synthetic soil aggregates were made of Clarion clay loam or Port Byron silt loam soils diluted with spherical glassbeads or with angular quartz sand of various quantities and sizes. The relative stabilities of the synthetic soil aggregates were determined by use of the wet sieving method. Synthetic aggregates from both soil generally decreased in stability as size of added quartz increased. However, angular quartz gave an increase in stability of Clarion clay loam aggregates as quartz particle size increased from 38 to 120 microns. At low dilution rates stability appeared to increase as particle size increased to 390 microns on this soil. Stability of aggregates was lower when diluted by spherical glassbeads than by angular quartz sand. On Clarion clay loam this difference was very marked. An expression of the empirical relationship between stability, size and quantity of added quartz was derived. (Woodard-USGS)
W71-01112

Field 02—WATER CYCLE

Group 2G—Water in Soils

ESTIMATES OF FIELD INFILTRATION INTO LAYERED SOILS,

Rutgers - The State Univ., New Brunswick, N.J. Dept. of Civil Engineering; and Clemson Univ., S.C. Dept. of Agricultural Engineering.

Riaz Ahmed, and James T. Ligon.

Paper No 69-740 presented at American Society of Agricultural Engineers Winter Meeting, Chicago, Illinois, December 9-12, 1969. 23 p, 10 fig, 17 ref. OWRR Project A-003-SC (8).

Descriptors: *Infiltration, *Soil water movement, *Water, Rates, Moisture content, Numerical analysis, Equations, Plants, Soil moisture, Moisture tension, Diffusivity.

Identifiers: *Moisture flow equation, Infiltration curves, Infiltration rate.

Infiltration rate curves were computed using a numerical solution of the unsaturated moisture flow equation. These curves were compared with actual field infiltration curves obtained with a Purdue-type sprinkler infiltrometer. The computed and observed infiltration curves compared reasonably well except in the early part of each run. (Woodard-USGS) W71-01113

AN EVALUATION OF PREDICTIVE METHODS OF DETERMINING THE EFFECTS OF SOLID-LIQUID PHASE INTERACTIONS ON THE MOVEMENT OF SOLUTES IN SOILS,

Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

R. C. Routson.

Available from NTIS as BNWL-1196, \$3.00 in paper copy, \$0.95 in microfiche. November 1969, 10 p. AEC Res and Dev Rpt BNWL-1196.

Identifiers: *Radiation shielding, *Scattering cross sections, *Tungsten, *Uranium, Capture effect, Lithium hydrides, Neutron irradiation, Resonance scattering.

An evaluation was made of the available methods, theories, and models which have been used to describe solid-liquid phase interactions which take place in porous media. Only the discontinuous-fixed plate model of Dutt was found to be a multi-tion approach which prior work on the Hanford project has shown to be necessary for a successful sorption description. The combination of Dutt's macroion approach and an empirical-statistical method of measuring trace radionuclide sorption was deemed to be the most fruitful approach for describing radionuclide concentration as a function of position and time. A computer program has been written and experiments have been designed to measure model parameters for testing the aforementioned approach. W71-01121

LEACHATE MOVEMENT IN THE SUB-SOIL BENEATH A SANITARY LANDFILL TRENCH TRACED BY MEANS OF SUCTION LYSIMETERS,

Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.

For primary bibliographic entry see Field 05B. W71-01204

SALT-FERTILIZER-SPECIFIC ION INTERACTIONS IN SOIL,

New Mexico State Univ., University Park. Dept. of Agronomy.

For primary bibliographic entry see Field 03C. W71-01283

SOIL PHYSICAL PROPERTIES ALTERED BY ADSORBED HYDROPHOBIC MATERIALS,

Dow Chemical Co., Midland, Mich.

G. H. Brandt.

In: Symposium on Water-Repellent Soils, Proceedings, University of California, Riverside, May 6-10, 1968, p 205-220, March 1969. 7 fig, 1 tab, 18 ref.

Descriptors: *Wettability, *Soil physical properties, *Adsorption, *Soil compaction, *Soil sealants, Soil structure, Soil water movement, Soil tests, Soil treatment, Soil investigations, Laboratory tests, Cohesion, Compaction, Compressibility, Moisture content, Density, Clays, Montmorillonite, Slurries, Chemicals, Repellents.

Identifiers: *Water-repellent soils, *Hydrophobic materials, Swelling.

Most of the physical effects of adsorbed hydrophobic materials are related to their influences on water adsorption and water structure adjacent to soil grains. The compressivities of several soils as measured by immersed strength increased with increasing amounts of hydrophobe, 4-tert-butylcatechol (TBC). Some, but not all, hydrophobes increase compactibility. Cohesive soil strengths as measured by relative anticrushing ability is affected by hydrophobes, but cannot be directly correlated with their soil waterproofing ability. X-ray data on TBC and 2-amino-4-t-butylphenol indicate that these substances are adsorbed on the edges of clay grains, blocking their expansion. The hydrophobic substances most effective in waterproofing are also most effective in limiting clay swelling. These effects are related to alteration of hydrostatic repulsion forces between soil grains. (Casey-Arizona) W71-01291

ECOLOGICAL EFFECT OF A CLAY SOIL'S STRUCTURE ON SOME NATIVE GRASS ROOTS,

South Dakota State Univ., Brookings. Dept. of Agronomy.

E. M. White, and J. K. Lewis.

Journal of Range Management, Vol 22, No 6, p 401-404, 1969. 2 tab, 22 ref.

Descriptors: *Soil structure, *Great Plains, *Grasses, *Root systems, *Clays, Ecology, Soil texture, Soil groups, Soil classification, Soil physical properties, Soil-water-plant relationships, Range grasses, Grama grasses, Wheatgrasses, Wilting point, Wettability, Rainfall, Drying, Cracking, Fine-textured soils.

Identifiers: *Peds.

In the Northern Great Plains, the Clayey Range Soil Group supports an understorey of short- and mid-grasses while the Dense Clay Range Soil Group supports no short grasses. This is the main criterion in differentiating these fine-textured soil groups since attempts to do so on the basis of texture and dispersion have been unsatisfactory. Efforts were made, therefore, to differentiate these soils on the basis of structure. At wilting point the peds of Clayey range soils are smaller, with more distinct prisms than those of Dense Clay range soils. This is indicative of the differing shrink-swell forces on roots in the 2 soils. The larger peds of the Dense Clays are bordered by cracks when dry, causing root stretching and constriction. As a result grasses with fine, spreading root systems cannot grow on Dense Clays. Summer showers are less beneficial for clay soils than silt soils because of: (1) less available water storage, (2) greater runoff loss and (3) lower wettability. (Casey-Arizona) W71-01295

ANISOTROPIC PERMEABILITY IN POROUS MEDIA,

Syracuse Univ., N.Y.

Philip A. Rice, Daniel J. Fontugne, and Raimondo G. Latini.

Industrial and Engineering Chemistry, Vol 62, No 6, p 23-31, June 1970. 9 p, 7 fig, 2 tab, 36 ref.

Descriptors: *Porous media, *Permeability, *Anisotropy, Permeameters, Soil mechanics, Resistivity, Measurement, Mathematical analysis, Soils, Experimental data, Soil water movement, Laboratory tests, Methodology, Flow rates, Hydraulic conductivity, Percolation, Bibliographies, Field tests, Flow, Apparatus.

Identifiers: *Porous media flow, *Permeability tests, In situ tests, Soil resistivity.

Methods of measuring directional permeabilities in anisotropic porous beds are reviewed for consolidated and unconsolidated media. Anisotropic permeability data on consolidated beds and unconsolidated beds are summarized, and the relationships among the bed formation process, the bed structure, and the observed anisotropic permeabilities are discussed. Anisotropy is generally a result of the orientation and shape of the asymmetric grains making up the porous bed. Measurements indicate that the extent of anisotropy can be approximately predicted by measurements of resistivity in different directions. Several methods for predicting the potential and stream functions in anisotropic porous media are cataloged. (USBR) W71-01387

WATER PERMEABILITY OF FROZEN SAND, Snow Ice and Permafrost Research Establishment, Wilmette, Ill.

V. D. Komarov.

Translated from Russian. Available from NTIS as AD-701 177, \$3.00 in paper copy, \$0.95 in microfiche. Also available as TT-61-19831. Trans of Materialy po Laboratornym Issledovaniyam Merzlykh Gruntov, Vol 3, p 142-148, 1957. U.S. Army Snow Ice and Permafrost Research Establ. Translation 66, January 1961. 5 p.

Identifiers: *Soils, Moisture, Freezing, Temperature, Absorption, Sand, Test methods, USSR, Translations, *Frozen soils, Groundwater.

The total amount of water and ice in frozen sand several hours after the test always remained considerably higher than the capillary moisture capacity of unfrozen sand. This is not without interest because one can easily imagine a process of considerable supersaturation of frozen sand as a result of alternating freezing and thawing. W71-01505

WATER CONTENT MEASUREMENT BY NEUTRON ATTENUATION FOR APPLICATION TO STUDY OF UNSATURATED FLOW OF SOIL WATER,

Washington State Univ., Pullman. Dept. of Agronomy.

Gordon L. Stewart, and Walter H. Gardner.

Available from NTIS as RLO 1543-5, \$3.00 in paper copy, \$0.95 in microfiche. Project 1543 report, 1969. 26 p, 1 tab, 8 fig, 5 ref. AEC AT (45-1)-1543.

Descriptors: *Soils, Moisture, *Hydrology, Neutron reactions, Thermal neutrons, Neutron cross sections, Non-destructive testing, Nuclear industrial applications.

Identifiers: Moisture content, *Groundwater.

Adequate testing of the applicability of various equations to studies of unsaturated water flow in soil requires a precise method for water content measurement. A neutron-matter interaction technique has been developed in this investigation to measure water contents of small volume elements of soil accurately, rapidly, and at frequent time intervals. This method can be used to measure water content in many types of experiments but it is particularly well suited for experiments involving transient flow. High thermal neutron fluxes, available at the present time only from nuclear reactors, are required. The method is superior to existing methods for measuring, non-destructively, water content as a function of time and position. The inherent precision due to the random nature of neutron production with a neutron count in dry soil of $6 \times 100,000$ c/m. for 2 second counting and a resolution of 1 mm. by 1 cm. for dry and wet water content regions (about 5% and 40% water) are about plus or minus 0.2% and plus or minus 0.4% water. For 30 second counting times the precisions improve to about plus or minus 0.05% and plus or minus 0.1% water. Longer counting times would lead to further improvement. Neutron attenuation is not seriously affected by density changes but soil bulk density can be measured by use of long counting times. Precision for soil bulk density measure-

ment is about plus or minus 0.002 gm./cc with counting times of about 200 seconds. With improved techniques and fluxes available at a 100 kw reactor it appears possible to improve the present resolution by a factor of 10 beyond that reported here.

W71-01524

HYDRAULICS OF LOW-GRADIENT BORDER IRRIGATION SYSTEMS,

Colorado State Univ., Fort Collins. Natural Resources Center.

Norman A. Evans, Dale F. Heerman, Orlando W. Howe, and Dennis C. Kincaid.
Available from NTIS as PB-195 784, \$3.00 in paper copy, \$0.95 in microfiche. Colorado State University Environmental Resources Center Completion Report, June 30, 1970. 55 p, 19 fig, 5 tab, 18 ref. OWRP Project No B-024-COLO (1).

Descriptors: *Irrigation systems, *Border irrigation, *Soil water movement, *Hydraulics, Surface irrigation, Infiltration, Soil tests, Infiltrimeters, Retardance, Soil density, Soil water, Clay loam, Resistivity, Storage capacity, Water balance, Analysis, Equations, Hydrographs, Mathematical models, Unsteady flow.

Identifiers: Hydrodynamic model, Dimensionless curves.

Surface flow data from field experiments on 21 borders were analyzed to determine parameters characterizing infiltration and surface retardance. Infiltration constants for a logarithmic intake function were determined by the use of cylinder infiltrimeters and by using the entire border as an infiltrimeter. The borders were constructed on a clay loam soil which exhibited cracking when dry. The infiltration analysis showed that for this type of soil, the cylinder infiltrimeters underestimate the infiltrated depth by nearly 50 percent. Resistance parameters were calculated by a volume balance procedure after the intake constants were determined. A mathematical model simulating border irrigation was developed by using the theory of unsteady hydrodynamics. The momentum and continuity equations were solved numerically by the method of characteristics. The advance of the wetting front was controlled by the requirement that the sum of the surface storage and infiltrated volumes must equal the total volume applied at all times. Dimensionless curves were derived relating the average surface storage depth to the advance distance. (Woodard-USGS)

W71-01545

2H. Lakes

RESERVOIR RIM STABILITY - LAKE ROOSEVELT. COLUMBIA BASIN PROJECT.

Bureau of Reclamation, Denver, Colo.

For primary bibliographic entry see Field 08E.

W71-01154

LIMNOLOGY STUDIES, AMCHITKA ISLAND, ALASKA,

Battelle Memorial Inst., Columbus, Ohio.

Derry D. Koob.

Available from NTIS as BMI-171-124, \$3.00 in paper copy, \$0.95 in microfiche. August 1969, various paging, Annual Progress report, FY 1969. Amchitka Bioenvironmental Program. Contract AT (26-1)-171.

Identifiers: *Alaska, Lakes, *Lakes, Chemistry, pH, Chlorides, Aleutian Islands, *Limnology, *Amchitka Island, Dissolved organic matter.

The limnological survey that was initiated in Fiscal Year 1968 was expanded to include an additional 25 lakes and ponds on the northwestern third of Amchitka. All lakes and ponds were differentiated into three groups on the basis of alkalinity and altitude. The Aleut Point Peninsula group was highly similar to the group of lakes in the Rifle Range region near Site B with respect to pH, alkalinity, and

chloride concentration. The high-altitude group (above 475 feet) was characterized by low alkalinity, low chloride, and pH's near 7. One lake in this group was biologically unique in that it contained large populations of fairy shrimp and red copepods. The concentrations of total organic matter were measured in 42 lakes and ponds on Amchitka, 25 of which are located on the northwestern third of the island. Most of the northwestern lakes contained less than 10 mg/l total organic matter, while the 17 southeastern ones generally contained more than this amount. The ratios of dissolved to particulate organic matter, along with rates of primary productivity and heterotrophic uptakes of acetate were measured for lakes between Site F and the main Atomic Energy Commission (AEC) camp. The concentrations of dissolved organic matter were characteristically much higher than the suspended particulate organic matter, except in acid, low-alkalinity lakes. In only two of the ten lakes sampled was the allochthonous organic matter considered to be of more importance than the autochthonous matter. Primary productivities were measured in the autumn and again in the spring. Of the eight lakes regularly sampled, five were productive and three were unproductive. Extremely high dark fixation rates occurred in the productive alkaline lakes near Site B. A test for alkaline phosphate activity supported the observation from FY 1968 that phosphate was limiting to primary productivity in many of the lakes of Amchitka. A comparison of correlations between various biological phenomena suggests that, of the eight lakes regularly sampled, three were productive and stable and three were unproductive and stable; the remaining two were productive but unpredictable with respect to correlations among primary productivity, heterotrophy, and concentration of organic matter.

W71-01160

THE SLOPE OF LAKE SURFACES UNDER VARIABLE WIND STRESSES,

Corps of Engineers, Washington, D.C. Beach Erosion Board.

B. Haurwitz.

Available from NTIS as AD-699 402, \$3.00 in paper copy, \$0.95 in microfiche. Technical Memorandum No 25, November 1951. 23 p.

Identifiers: *Lake waves, Wind, Tropical cyclones, Surfaces, Florida, Beaches, Erosion, Lake Okeechobee, Beach erosion, Seiches, Air water interactions.

The inclination of a lake surface caused by a wind stress shows a distinct time lag in adjusting itself to changing winds. To analyze this phenomenon use is made of the hydrodynamic equations which are simplified by integrating over the whole depth of the lake. It is found that the time required by the lake to respond to changing wind stresses depends on the length of the seiche periods. Particular attention is given to the case of a wind which changes its direction. Such a wind shift took place during the passage of the hurricane of 26-27 August 1949, over Lake Okeechobee, Florida, when the wind turned through about 180 degrees during a time of roughly three hours. This turning of the wind was accompanied by a turning of the height contours of the lake surface, but the latter rotated more slowly than the wind direction so that for some time the wind blew parallel rather than perpendicular to the isohypses. It is shown that the theory explains this behavior of the lake surface.

W71-01183

CHANGES IN WATER ENVIRONMENT RESULTING FROM AQUATIC PLANT CONTROL,

Wisconsin Univ., Madison. Water Resources Center.

For primary bibliographic entry see Field 04A.

W71-01196

PROCESSING CHARACTERISTICS OF SUB-SURFACE MACROPHYTES OF MADISON,

WISCONSIN LAKES IN RELATION TO MECHANICAL HARVESTING SYSTEMS,

Wisconsin Univ., Madison. Water Resources Center.

For primary bibliographic entry see Field 04A.

W71-01197

METHODS OF CALCULATING STEADY AND UNSTEADY CURRENTS IN HOMOGENEOUS LAKES,

Cornell Univ., Ithaca, N.Y.

James A. Liggett.

French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 103-112, 1969. 10 p, 3 fig.

Descriptors: *Waves (Water), *Water circulation, *Lakes, Storms, Winds, Fluid mechanics, Mathematical studies, Mathematical models, Currents (Water).

Identifiers: Lake circulation.

Three methods for computing wind-driven lake circulation are summarized. Each considers a shallow (large horizontal dimension compared to depth), homogeneous lake on a rotating earth. In each case the lake circulation is three-dimensional. The wind stress functions are specified in the boundary conditions and no hypothesis is made concerning the surface phenomena. The first method is a steady-state, linear theory with horizontal diffusion of momentum neglected. The second adds the time derivative to the equations in order to compute unsteady flow. The third method considers all terms of the equations of motion. As the equations become more complex, more of the solution must be carried out numerically. Finally, an example of a storm passage over a lake which is initially at rest is presented. (Knapp-USGS)

W71-01244

PHYSICOCHEMICAL CONDITIONS OF DEPOSITION OF BACILLARIOPHYTA IN DAVIS LAKE, KLAMATH AND DESCHUTES COUNTIES, OREGON, U.S.A.,

Northeast Louisiana State Coll., Monroe. Dept. of Biology.

S. Messina-Allen, and Sam L. Van Landingham.

Hydrobiologia, Vol 35, No 1, p 31-44, 15 June 1970. 2 fig, 2 tab, 43 ref.

Descriptors: *Diatoms, *Deposition (Sediments), *Physicochemical properties, *Lake stages, Lake soils, Semiarid climates, Oregon, Aquatic microorganisms, Lava, Seepage, Ecology, On-site data collections, Plankton, Hydrogen ion concentration, Lakes.

Identifiers: *Bacillariophyta, Fossil diatoms.

The collection of fossil diatoms enables a determination of their probable environment of deposition on the assumption that the physicochemical environment of a modern taxon was also characteristics of fossil forms of the same taxon. Davis Lake lies on the semiarid eastern slope of the Oregon Cascade Range in an area that is slowly drying up. Since outflow is by seepage through associated lava formations, the lake was probably formed by lava blockage of stream flow. Diatom deposits were collected, analyzed and compared with data from other lakes. The population consisted of both planktonic and non-planktonic forms. The inferred deposition conditions were: (1) Alkaliphilous, in contrast to many western Cascade lakes, (2) oligohalobous (indifferent), (3) oligosaprobic and (4) eutrophic. Current conditions are limnobiontic to indifferent. Probably deposition occurred in a bog or swale which served as a runoff basin for volcanic uplands. (Casey-Arizona)

W71-01288

Field 02—WATER CYCLE

Group 2H—Lakes

AGRICULTURAL CONTRIBUTION TO THE EUTROPHICATION PROCESS IN BEAVER RESERVOIR,

Arkansas Univ., Fayetteville. Dept. of Civil Engineering.
R. A. Gearheart.

For presentation at the 1969 Winter Meeting American Society of Agricultural Engineers, Chicago, Illinois, Dec 9-12, 1969. American Society of Agricultural Engineers, Paper No 69-708, 1969. 21 p, 6 fig, 2 tab, 22 ref. OWRR Project B-012-ARK (3).

Descriptors: *Eutrophication, *Reservoirs, Nitrogen, Phosphorus, Runoff, Domestic wastes, Rainfall, Agricultural watersheds.

Identifiers: *Beaver Reservoir (Ark), White River, Fayetteville (Ark).

A study of eutrophication of the Beaver Reservoir (Arkansas), disclosed that the major contribution of nitrogen and phosphorus was provided by runoff from farm lands occupying a watershed of some 900 square miles. The total nitrogen and total phosphorus from this source averaged annually 3.2 and 2.1 lb/acre, respectively. The contribution of domestic waste effluent was considerably reduced by the recent installation of treatment facilities. Yet, the City of Fayetteville's annual production of domestic waste totals 14 lb of nitrogen and 4.1 lb of phosphorus per capita of its 30,000 population. The urban runoff added on the average 5% of total nitrogen and 2% of total phosphorus. The addition of nitrogen by rainfall approximated 8%. (Wilde-Wisconsin)
W71-01375

EUTROPHICATION-TROPHIC STATE RELATIONSHIPS IN NORTH AND CENTRAL FLORIDA LAKES,

Florida Univ., Gainesville.

Earl E. Shannon.

Doctoral dissertation for PhD, University of Florida, 1970. 256 p, 11 fig, 34 tab, 274 ref, 3 append. OWRR Project B-004-FLA (1).

Descriptors: *Trophic level, *Lakes, *Eutrophication, *Florida, Biomass, Primary productivity, Nutrients, Dissolved solids, Conductivity, Indicators, Dissolved oxygen, Sediments, Water pollution sources, Water pollution effects, Mathematical models, Model studies, Statistical models, Sampling, Analytical techniques, Regression analysis.

Identifiers: Transparency, Trophic state indicators, Trophic state index, Trophic state classification, Canonical correlation, Cation ratios.

The relationships between trophic state of lakes and eutrophication factors were examined using multivariate statistical techniques. The analytical data were derived from 55 Florida lakes. A trophic state index (TSI) incorporated 7 indicators: primary production, chlorophyll a, total nitrogen and phosphorus, transparency, conductance and cation ratio. A positive correlation was established between trophic state, lake basin population, and land use. Regression and canonical analyses indicated that the most influential eutrophication contributors are heavy fertilization and lake shore residences without sewer facilities. (Wilde-Wisconsin)
W71-01378

STUDIES ON THE EFFECTS OF ABNORMALLY HIGH WATER LEVELS ON THE ECOLOGY OF FISH IN CERTAIN SHALLOW REGIONS OF LAKE VICTORIA,

East African Freshwater Fisheries Research Organization, Jinja (Uganda).
R. L. Welcomme.

Journal of Zoology, London, Vol 160, No 4, p 405-436, April 1970. 9 fig, 17 tab, 32 ref.

Descriptors: *Freshwater fish, *Lake stages, *Lagoons, *Ecology, *Water levels, Environmental effects, Habitats, Ecosystems, Animal metabolism,

ism, Fish behavior, Fisheries, Semiarid climates, Fish barriers, Fish populations, Fish establishment, Fish migration, Floating plants, Water temperature, Flooding, Oxygen, Vegetation establishment. Identifiers: *East Africa, *Cichlid fish, *Lake Victoria, *Species diversity, *Deoxygenated waters.

Since 1961 water levels at Lake Victoria have been at record-breaking highs. Unstable, vegetation-choked, isolated and semi-isolated lagoons not usually present have appeared at varying distances from the main body of the lake. The fish populations of these isolated lagoons were studied and compared to those of the lake. Shortly after their formation the lagoons were colonized by various species of introduced cichlid genera. Species composition depended on the degree of isolation from the lake. In the more isolated lagoons only 2 colonizers were present, *Tilapia leucosticta* and *Haplochromis nubilus*. The factors accounting for this are deoxygenated water conditions under the floating vegetation, making extensive movement hazardous, and near lethal temperature levels. Isolated populations of the 2 species showed a conspicuous stunting phenomenon which often also occurs in fish ponds. This is due to a number of factors such as the buildup of inhibitory metabolites. The floating vegetational mats with their associated deoxygenated waters apparently act as biological filters. Studies of this type will result in improvements in managed fish production in the lake. (Casey-Arizona)
W71-01394

BEHAVIORAL AND PHYSIOLOGICAL RESPONSES TO TEMPERATURE IN THE DESERT PUFFFISH CYPRINODON MACULARIUS,

Arizona Univ., Tucson; and Western Washington State Coll., Bellingham.

Charles H. Lowe, and Wallace G. Heath.

Supported in part by the Rockefeller Foundation, the University of Arizona and the U.S. National Park Service. Physiological Zoology, Vol 42, No 1, p 53-59, January 1969. 3 fig, 2 tab, 15 ref.

Descriptors: *Fish behavior, *Arid lands, *Water temperature, *Heat resistance, *Physiological ecology, Laboratory tests, On-site investigations, Thermophilic animals, Animal physiology, Arizona, California, Ecology, Animal behavior, Habitats, Southwest U.S., Acclimatization, Thermal stress, Seasonal, Winter, Summer, Ponds, Deserts, Fluctuation, Temperature, Microenvironment.

Identifiers: *Critical thermal maximum, *Desert waters, *Desert pupfish, Thermoregulation, Sonoran Desert, Organ Pipe Cactus National Monument, Survival.

The desert pupfish inhabits shallow southwestern desert ponds which undergo wide daily and annual temperature fluctuations. Laboratory and field investigations were undertaken to determine the critical thermal maxima (CTM) of these fish and the mechanisms whereby they survive high water temperatures. The maximum CTM is 44.6 degrees C. in Arizona, apparently the highest yet recorded for fish. Summer and winter CTMs are quite different and seasonal acclimation determines survival capabilities since winter seasonal acclimated pupfish would die in several areas of their natural summer thermal environment in Arizona. Behavioral thermoregulation is a critical survival mechanism and younger fish select warmer thermal microenvironments than adult fish of the same population. Behavioral thermoregulation at temperatures near the CTM is common. Behavioral thermoregulation is an early phylogenetic development in vertebrates. (Casey-Arizona)
W71-01395

THE MEROMIXIS OF SUNFISH LAKE, SOUTHERN ONTARIO,

Waterloo Univ. (Ontario). Dept. of Biology.

Hamish C. Duthie, and John C. H. Carter.

Journal Fisheries Research Board of Canada, Vol 27, No 5, p 847-856, 1970. 5 fig, 1 tab, 16 ref.

Descriptors: *Meromixis, *Phytoplankton, *Circulation, Seasonal, Epilimnion, Cycling nutrients, Oxygen, Dissolved solids, Subsurface waters, Springs, Algae, Geology, Hemlock trees, Chara, Sulfides, Depth, Hydrography, Temperature, Dissolved oxygen, Hydrogen ion concentration, Alkalinity, Phosphates, Nitrates, Ice, Sediments, Stratification, Chemical analysis, Sulfates.

Identifiers: *Sunfish Lake (Ontario), Metalimnion, Oscillatoria agardhii, Monimolimnion, Mixolimnion, Blooms.

In a meromictic lake efficiency of exchange between mixolimnion and monimolimnion to a great extent controls trophic level of the euphotic zone. In a permanently meromictic lake the monimolimnion acts as a nutrient trap, particularly if the importation of nutrients from the watershed is low and the lake is small, sheltered, and relatively deep, primary productivity will be low. This study was undertaken to explain the occasional appearance of large algal blooms in upper waters of meromictic Sunfish Lake, a small lake whose phytoplankton productivity is ordinarily low. The periodic large phytoplankton populations were associated with circulation of the mixolimnion. Perhaps some organic dissimulation took place in lower mixolimnion, recycling nutrients during spring and fall circulation. Phytoplankton was practically absent from the epilimnion in summer but a population of *Oscillatoria agardhii* remained in the metalimnion, where it was responsible for a pronounced and persistent metalimnetic oxygen maximum. The monimolimnion contained about 5100 milligrams/liter of dissolved solids and the upper mixolimnion about 2200 milligrams/liter. Ventilation of the monimolimnion did not always coincide with circulation and subsurface springs may have been responsible. Circulation to lake bottom was observed only once in 18 months. (Jones-Wisconsin)
W71-01476

ONE OF THE QUANTITATIVE CHARACTERISTICS OF THE STRUCTURE OF PHYTOPLANKTONIC ASSOCIATIONS OF THE BRATSKII BASIN (IN RUSSIAN),

O. M. Kozhova.

Doklady Akademii nauk SSSR, Vol 187, No 5, p 1165-1168, 1969. 1 fig, 2 tab, 6 ref.

Descriptors: *Phytoplankton, *Productivity, Diurnal, Biomass, Phosphorus, Oxygen, Seasonal, Carbon, Algae.

Identifiers: Phosphorus-biomass ratio, Biotic diversity, Lake Baikal.

The productive potential of phytoplankton in the Bratskii retention basin was appraised on the basis of the P/B ratio, where P (phosphorus) is the total diurnal production determined by the oxygen method, and B is the biomass of the phytoplankton. Both values were obtained simultaneously and recalculated to carbon at the ratio C — 10% of the fresh weight of algae. The P/B ratio failed to be significantly correlated with the Margalev's index of biotic diversity ($r = 0.24$). The coefficient P/B varied during the time of investigations from zero to 8.2 with the arithmetic average of 1.6. The latter value can be considered as characteristic for the Bratskii basin after its 3 years of existence. (Wilde-Wisconsin)
W71-01485

USE OF TRITIUM TO STUDY WATER DYNAMICS OF LEMAN (LAKE GENEVA) (IN FRENCH),

Pierre Hubert, Michel Meybeck, and Philippe Olive.

Comptes Rendus Academie des Sciences, Paris, Vol 270, Serie D, p 1298-1301, 1970. 3 fig, 1 tab, 9 ref.

Descriptors: *Lakes, *Dynamics, *Tracers, Tritium, Physicochemical properties, Floods, Rivers, Precipitation (Atmospheric).

Identifiers: Lake Geneva, Dynamic patterns, Chronological pattern, Rhine River, Strata.

Within the capacity of isotope tracers, tritium permitted to differentiate water masses of different physicochemical composition. Moreover, the tracer provided a chronological pattern of dynamic changes of the lake. The Lake Geneva exhibits 3 more-or-less pronounced strata of different dynamic behavior: the surface 0-50 meter layer affected by thermal convection; the intermediate layer, from 50 to 150 meter depth, playing the most important part in the renovation of water; the deep layer, below 150 meters, presenting the realm of great inertia. The 5-year study of the central part of the lake revealed a persistent enrichment of its content, at an approximate depth of 100 meters, by waters from the preceding year floods of the River Rhone. (Wilde-Wisconsin)

W71-01490

EXPERIMENTAL EVIDENCE OF CHEMICAL WEED ERADICATION IN LAKE TRASIMENO (IN ITALIAN),
Perugia Univ. (Italy). Inst. of Hydrology and Fish Culture.

Giampaolo Moretti, Livio Zinnai, and Carlo Antonelli.

English summary. Rivista di Idrobiologia, Vol 1, No 2-3, p 95-114, 1962.

Descriptors: *Herbicides, *Lakes, Aquatic plant control, Chemcontrol, Physical control, Inhibitors. **Identifiers:** Phragmites communis, Lake Trasimeno (Italy), N P herbicide.

The dense cover of Phragmites communis in and around Lake Trasimeno, Umbria (Italy), was successfully eradicated by the herbicide N P, comprised of 60% sodium dichlorobutyric acid and 40% chlorinated fatty acids. The compound was used only once during the period July to September. Approximately 30 kg of the N P in 10 to 15 hectoliters of water per hectare were sprayed evenly on aerial parts of plants. The treatment arrests the formation of chlorophyll and devitalizes the rhizomes. A combination of the chemical and mechanical eradication provided a particularly effective rapid, and inexpensive control of the undesirable hydrophytes. (Wilde-Wisconsin)

W71-01493

AN IMPLEMENT FOR TAKING LARGE UNDISTURBED CORE SAMPLES FROM LAKE SEDIMENTS (IN GERMAN),

Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).

Heinz Ambuhl.

English summary. Schweizerische Zeitschrift fur Hydrologie, Vol 31, No 1, p 132-140, 1969. 8 fig, 4 ref.

Descriptors: *Instrumentation, *Cores, Sediments, Sampling, Lakes. **Identifiers:** Deep lake core sampling.

The described device for collection of sediment core samples from deep lakes consists of a cylinder having a 112-millimeter interior diameter. Loss of sampled material is precluded by a closing mechanism. The separation of an undisturbed core sample from the closing mechanism is accomplished by a blade on a special cutting table. (Wilde-Wisconsin)

W71-01494

DETERMINATION OF ASSIMILABILITY OF ALGAE, YEASTS, AND BACTERIA BY CERTAIN REPRESENTATIVES OF CLADOCERA (IN RUSSIAN),

V. K. Fedorov, and Yu I. Sorokin.

Doklady Akademii nauk SSSR, Vol 174, No 4, p 969-970, 1967. 1 tab, 5 ref.

Descriptors: *Foods, *Radioactive techniques, *Crustaceans, Aquatic populations, Daphnia, Tracking techniques, Algae, Yeasts, Bacteria, Laboratory tests, Plankton. **Identifiers:** C-14 analysis, Food assimilation, Simocephalus vetulus.

The difficult task of determining food assimilation is considerably simplified by the use of C-14 analysis. The objects of this study—Daphnia longispina and Simocephalus vetulus—were fed by bacteria, pink yeasts, and alga Chlorella. Bacteria and yeasts were labeled by their cultivation in the medium of C-14 glucose; the algae, in a medium with radioactive carbonate. Following a period of adaptation, 50 to 100 crustaceans were placed for 20 minutes in a vessel with water containing 10 to 15 mg/liter of food organisms. At the beginning and at the end of trials, samples of water were passed through a membrane filter and the activity of the dried filtrates determined by a counter. The amount of food consumed by the crustaceans was calculated from the difference in readings taking into consideration the number of organisms and the reciprocal specific radioactivity or organic carbon of the food. The trials were duplicated in water adjusted to pH 8.2 and enriched with unlabelled food organisms. Daphnia assimilated yeasts better than other food sources. Simocephalus assimilated bacteria best, slightly less algae, and yeasts least efficiently. (Wilde-Wisconsin)

W71-01496

IMPORTANCE OF PROVISION WITH FOOD FOR THE SURVIVAL OF FISH LARVAE (ON AN EXAMPLE OF THE BREAM OF RYBINSK RESERVOIR),

Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.

D. A. Panov.

Available from NTIS as PB-189 894T, \$3.00 in paper copy, \$0.95 in microfiche. Translated from Biologiya i Troficheskie Svyazi Presnovodnykh Bespozvonochnykh i Ryb. Sbornik Statei. Akademiya nauk SSR, Institut Biologii Vnutrennikh Vod, Trudy, No 17 (20), 'NA', Leningrad, 1968, p 199-221. Russian translation by Narragansett Marine Game Fish Research Lab, June 1969. 32 p.

Identifiers: Food chains, *Fishes, Larvae, *Larvae, Food, *Lakes, Fishes, Nutrition, Population, Ecology, Acclimatization, Nutrition, Marine biology, USSR.

The fish productivity of the majority of existing reservoirs is very low. By 3-4 times, and sometimes even more, it yields to the fish productivity of lakes situated in identical climatic zones. One of the first steps taken to increase the fish productivity of reservoirs was acclimatization of new species of fish. It was considered that since waters of a new type with new conditions are created, then the old river forms of fish cannot fully accept all of the ecological niches in them. For a number of reasons, including the low food abundance of reservoirs, this measure proved to be rather ineffective. It yielded no substantial positive results nor did the acclimatization of invertebrates. Radical improvement of the food base can be attained only through fertilization of the reservoir, which lead to improvement of feeding conditions for the invertebrates. The data presented permit one to consider that increase of the food base for larvae, especially at early stages of development, can bring about increase of the yield of young in Rybinsk Reservoir, and consequently also increase of the abundance of fish generations and the whole stock.

W71-01506

ACOUSTIC TECHNIQUES OF FISH POPULATION ESTIMATION WITH SPECIAL REFERENCE TO ECHO INTEGRATION,

Washington Univ., Seattle, Fisheries Research Inst. Richard E. Thorne, and Henry W. Lahore.

Available from NTIS as PB-190 388, \$3.00 in paper copy, \$0.95 in microfiche. Circular No 69-10, September 22, 1969. 12 p, 6 fig, 17 ref. NSF Grant GH-40.

Identifiers: Fish surveys, Echo integrators, Merlucius products, Clupea harengus, Onchorhynchus merka.

An effort was made to develop a system that could be used to enumerate both adult and juvenile sal-

mon. The schooling habits of these fish preclude a direct enumeration of individual fish, and the effort was centered on an estimate of the biomass of fish through integration of the reflected echosignals. These, in turn, must be converted into population estimates by a test-fishing program. The report contains a brief description of the developed integrator and the calibration experiments on stocks of hake and herring in Puget Sound.

W71-01508

ECOLOGICAL-PHYSIOLOGICAL PECULIARITIES OF CERTAIN SPECIES OF FISH,

Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.

P. A. Korzhuev.

Available from NTIS as PB-189 898T, \$3.00 in paper copy, \$0.95 in microfiche. Translated from Trudy Soveshchaniy Ikhtiol. Komis. Akad. nauk SSSR, 1958. 8: 364-371. Russian translation by Narragansett Marine Game Fish Research Lab., November 1969. 9 p, 3 tab, 6 ref.

Identifiers: *Fishes, *Physiology, *Ecology, Fishes, Environment, Blood, Hemoglobin, Erythrocytes, Body weight, Oxygen, Morphology (Biology), Adaptation (Physiology), Musculoskeletal system, Skin, Blood circulation, Respiration.

Different oxygen concentration in water, which is determined by a number of conditions, is a very important factor which influences the distribution of various aquatic organisms, and especially fish, as the most active representatives of aquatic animals. The adaptation of fish to some or other conditions of existence naturally is specified not only by their relationship to oxygen, but also the possibility of accomplishment of such vital functions as feeding and reproduction. Nevertheless, the accomplishment of these functions becomes possible only with steady provision of the organism with oxygen. For this reason, considerable interest is generated by study of the physiological mechanisms which supply the organism with oxygen under different conditions of existence. Such study permits understanding of the reason for the different relationship of different fishes to one or another regime, for in this the concrete forms of the connection of the organism and the environment are revealed. Only in a plan wherein concrete investigations are formed in accordance with the principle of unity of the organism and the environment, with consideration of the peculiarities of the environment, can the most important sides of the connections between the organism and environment be revealed.

W71-01510

ON THE SOARING OF NON-MOTILE PLANKTONIC ALGAE,

Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.

A. P. Skabichevskii.

Available from NTIS as PB-189 893T, \$3.00 in paper copy, \$0.95 in microfiche. Translated from Uspekhi Sovremennoi Biologii, Vol 26, No 1 (4), 1948, p 615-618. Russian translation by Narragansett Marine Game Fish Research Lab., June 1969. 5 p, 10 ref.

Identifiers: *Plankton, Sedimentation, Adaption (Physiology), Density, Weight, Environment, Ecology, Algae, Water, Physiology, Gravity, Marine biology, USSR.

The entire life of planktonic organisms takes place in the water thickness, and the sole support of their body is the water mass. But water, as is well known, is not so dense a medium that even insignificant bodies could be retained in it. Sooner or later suspended matter must precipitate to sediment, if, of course, the suspended bodies are heavier than water. In the process of natural selection in planktonic organisms, adaptations were produced which enabled their support in the water thickness. Such adaptations include organs of active movement, decrease of the body weight through the development of light-weight assimilators, thinning down of

Field 02—WATER CYCLE

Group 2H—Lakes

the cell wall, and the formation of gas vacuoles. Finally, there are also very diverse parachute adaptations which lead to increase of the total body surface. To them belong the flat- or needle-like body shape of many unicellular organisms, the formation of flat, stellate, filamentous colonies, the secretion of slime, etc. However, despite all of these adaptations the absolute weight of plankters remains considerable and for the most part in excess of the weight of water. Calculation of this, and also the conditions of the environment permitted Ostwald in 1902 to express a theory of soaring of planktonic organisms, according to which their residence in a suspended state is descent at a minimal rate. The rate of sinking, according to Ostwald, is proportional to the residual weight, and inversely proportional to the form of resistance and to the viscosity of the water. Ostwald presented this position in the form of his well-known formula: $a = b/c(d)$ where a - is the rate of sinking, b - is the residual weight of the plankton, c - is the form of resistance, d - is the internal resistance (viscosity) of the water. W71-01511

NUMERICAL CALCULATIONS OF THE STEADY-STATE, WIND-DRIVEN CURRENTS IN LAKE ERIE,

National Aeronautics and Space Administration, Cleveland, Ohio. Lewis Research Center. Richard Gedney, and Wilbert Lick.

Available from NTIS as N70-26980, \$3.00 in paper copy, \$0.95 in microfiche. Thirteenth Conference on Great Lakes Research, Buffalo, N.Y., March 31-April 3, 1970. Typescript, 12 p, fig. NASA TMX-52786.

Identifiers: *Conferences, Fluid flow, *Lakes, *Mathematical models, *Wind effects, Currents.

Solutions for the steady-state, wind-driven currents in Lake Erie have been obtained by numerical methods. A shallow lake model, which does not require the friction layers to be small by comparison with the depth of the lake, has been used. In order to obtain some of the observed features of the currents, it was necessary to use a relatively small grid (3.22 kilometers). This grid was variable in size for the mesh points adjacent to the boundaries, thus permitting an accurate approximation of the boundary. The velocity as a function of depth and horizontal position has been determined. Results are presented for southwesterly and northeasterly winds. In both cases, narrow bands of strong currents were found near the shore. In other areas, large subsurface gyres were evident. The calculated results compare quite well with seabed drifter measurements and other observations. W71-01517

AN ACT RELATING TO PERMITS FOR DREDGING AND ERECTION OF CAUSEWAYS, DOCKS, ETC. IN TRIBUTARIES OF GREAT PONDS.

For primary bibliographic entry see Field 06E. W71-01554

2I. Water in Plants

SEASONAL PHENOMENA IN THE PLANKTON OF THE LABRADOR SHELF, THE GRAND BANK OFF NEWFOUNDLAND AND FLEMISH CAP,

Naval Oceanographic Office, Washington, D.C. T. N. Semenova.

Transl. from Russian. Available from NTIS as AD-705 043, \$3.00 in paper copy, \$0.95 in microfiche. 1969, 22 p. Naval Oceanographic Office Trans 421.

Identifiers: *Plankton, Newfoundland (Province), Production, Statistical analysis, Counting methods, Classification, Atlantic Ocean, USSR, Translations, Labrador Shelf, Grand Banks, Flemish Cap, Northwest Atlantic Ocean, PINRO expedition.

The study is based on data collected by several PINRO expeditions in the spring-summer of 1960

and from the summer of 1961 to the summer of 1962 in the NW Atlantic. Data published by American researchers have been utilized to present a comprehensive survey of plankton production on the Grand Bank, Flemish Cap and in surrounding areas. The numerical values and variations of zoo- and phytoplankton biomass with seasons and areas are given, singling out the major zooplankton species. In this connection the existence of various water types, their origins and movements, is brought into discussion. Some of the typical data are graphed and tabulated. W71-01168

THE INFLUENCE OF INADEQUATE WATER SUPPLY ON METABOLISM IN BIOLOGICAL SYSTEMS WITH EMPHASIS ON PROTEIN SYNTHESIS AND NUCLEIC ACID METABOLISM,

Florida Univ., Gainesville. Water Resources Research Center. S. H. West.

Available from NTIS as PB-195 666, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, Publication No 9 of the Florida Water Resources Center, August 1970. 12 p, 14 ref. OWRR Project A-008-FLA (1).

Descriptors: *Water supply, *Water shortage, Water utilization, *Plant growth, Metabolism, *Droughts, *Water consumption (Plants), Soil moisture, Drainage.

Data have been obtained that show the effect of drought on growth itself and how this reduction in growth may be a result of specific changes in total protein production, nucleic acid metabolism and on functional activity of a fraction of nucleic acids. While the drought treatments decreased total protein by only 40%, growth was reduced 80%. These data suggested that the synthesis of growth-dependent proteins was being hindered. Although total nucleic acid production was not reduced by the lack of water, the function of the nucleic acid fraction responsible for delivering the genetic information to the process of protein synthesis was altered. This fraction of nucleic acid was not, under water-stress conditions, getting attached to ribosomes. This malfunction prevented the synthesis of a proline-rich protein which is probably required for cell wall production during growth. This information provides a specific selection criterion and should aid in the development of plants and perhaps other organisms that can withstand stress from drought. W71-01191

SOIL WATER AND TREE GROWTH IN A GREAT PLAINS WINDBREAK,

Forest Service (USDA), Lincoln, Neb., Rocky Mountain Forest and Range Experiment Station. D. H. Sander.

Soil Science, 1970, Vol. 110, No 2, p. 128-135, 6 tab, 3 fig, 11 ref.

Descriptors: *Soil-water-plant relationships, *Plant growth, *Windbreaks, *Trees, *Soil water, Moisture content, Limiting factors, Great Plains, Growth rates, Snowmelt, Nebraska, Arid lands, Evapotranspiration, Water loss, Root systems, Soil profiles, Precipitation (Atmospheric), Soil water. Identifiers: *Limiting tree growth, Snow accumulation.

Soil water is one of the most important factors limiting tree growth in the Great Plains. Soil water regime and tree growth in a 21-year old 10-row windbreak in eastern Nebraska were investigated. Soil water content was determined by the neutron-tube method to a depth of 11 feet, and tree diameter growth was recorded throughout 1960 to 1963. Soil water use was characterized by depletion from the surface soil early in the growing season and from deeper layers of the soil profile later in the season. Snow accumulation was a valuable water source for windbreak trees. There was a trend of reduced growth during the low moisture years.

Stem basal area growth increased from current early season precipitation and soil water reserves from the upper 6 or 7 feet of soil. Windbreak trees in the Great Plains grow and survive primarily on current precipitation. Results suggest that soil water supply is adequate to establish trees where old rows have been removed in windbreaks in the eastern Plains. Included are tables and graphs of species, height, profile characteristics, water balance, recharge, loss and basal area increase. (Popkin-Arizona) W71-01280

ORNAMENTALS FOR CALIFORNIA'S MIDDLE ELEVATION DESERTS,

California Univ., Davis. Div. of Agricultural Sciences.

Mildred E. Mathias, W. Metcalf, M. H. Kimball, C. L. Genistreet, and D. E. Gilbert.

California Agricultural Experiment Station, Bulletin 839, March 1968. 44 p, 7 fig, 4 tab, 1 map (fold-out in pocket).

Descriptors: *Ornamentals, *California, *Desert plants, *Ecological distribution, Arid lands, Biogeography, Environmental effects, Climatology, Deserts, Drought tolerance, Climatic data, Planting management, Temperature, Trees, Shrubs, Great Basin.

Identifiers: *Middle Elevation Desert, *Elevation-controlled desert, *Plantclimates, Colorado Desert, Death Valley, Great Basin Desert, Mojave Desert, Plant communities.

California's 3 deserts occupy 37% of the state and lie east of mountainous barriers to moist Pacific air. They are in Plantclimate V and include the High Elevation Desert (Great Basin Desert), the Low Elevation Desert (Colorado Desert, Death Valley) and the Middle Elevation Desert (MED). The MED with 38,800 sq. mi. and arid-warm temperate to sub-alpine climates is California's largest. It contains half of the Mojave Desert. Fruit and nut growing here depend on winter temperature breaking dormancy, spring and fall frost, summer temperature, thermal belts, exposures and shelters. Controls for plant selection are water supply and quality, soils and management. Climatic factors are two kinds of cold (normal seasonal low and 50-yr freeze), rainfall, sunshine, humidity, growing season, wind and windbreaks. Native ornamental plants depend on water needs, drought and climatic-extreme tolerancy. A table presents temperature data in plantclimate subzones. A list of 380 plants known to grow satisfactorily is scored to 3 grades of drought tolerancy. Figures of temperature zones, rainfall distribution, plantclimate subzones and elevation-controlled desert boundaries are included. There is a 12-item glossary. (Popkin-Arizona) W71-01281

A COMPARATIVE STUDY OF THE INTEGUMENT OF THE CAMEL, DORCAS GAZELLE AND JERBOA IN RELATION TO DESERT LIFE,

Khartoum Univ. (Sudan). Dept. of Zoology. Laurie I. Ghobrial.

Journal of Zoology, London, Vol 160, No 3, p 509-521. 4 fig, 3 tab, 9 ref.

Descriptors: *Arid lands, *Xerophilic animals, *Evaporation, *Water conservation, *Sweat, Water balance, Mammals, Transpiration, Epidermis, Animal physiology, Mode of action, Physiological ecology, Animal groupings, Temperature, Cooling, Water loss.

Identifiers: *Integument, *Histology, *Camels, *Gazelles, *Jerboas, Apocrine sweat glands, Sebaceous glands, Hair, Sudan.

Physiological water conservation mechanisms in desert animals other than man have been little studied. Comparative histological studies were made on 3 animals in an effort to relate morphology to arid area survival. Tubular-type sweat glands were present in both the gazelle and camel. They were

spread singly over the body surface in the gazelle and occurred in groups under clusters of hairs in the camel. Because of surface area/volume ratio problems, the jerboa probably cannot afford to perspire. Both the unkeratinized epidermis and horny layers were thin in the gazelle and jerboa. In dry air these relatively thin epidermal coverings may permit some water loss by transpiration. The gazelle has 2 types of hair -- long and short. Both types occur singly and are associated with sebaceous glands. They may be raised and a humid air layer may occur, leading to cooling even though evaporation is reduced. (Casey-Arizona) W71-01285

WATER AND ELECTROLYTE BALANCE OF THE DESERT IGUANA, DIPLOSOSAURUS DORSALIS, IN ITS NATURAL HABITAT,

Michigan Univ., Ann Arbor. Dept. of Zoology.

John E. Minnich.

NSF Grant GB-2447. Comparative and Biochemical Physiology, Vol 35, No 4, p 921-933, 15 August 1970. 2 tab, 34 ref.

Descriptors: *Xerophilic animals, *Urine, *Electrolytes, *Water balance, *Salt balance, Cloaca (Zoological), Animal metabolism, Animal physiology, Reptiles, Data collections, Circulation (Animals), Mode of action, Moisture stress, Physiological ecology, Osmotic pressure, Arid lands, Water loss, Hydrogen ion concentration.
Identifiers: *Lizards, *Body fluid volumes, *Urate salts, *Desert iguana, *Excretion, Salt gland, Kidney.

Desert animals make very economical use of the little moisture available to them. The water intake of the desert iguana has a much higher salt content than its body fluids, but the animal is incapable of secreting a urine hyperosmotic to its blood nor does the salt gland appear functionally important in maintenance of salt balance. Plasma, extracellular and intracellular fluid volumes and electrolyte concentrations were measured in desert iguanas captured in different seasons. The animals were neither dehydrated nor did they exhibit tissue electrolyte accumulation. The distributions of body fluids in the various fluid compartments were directly proportional to the fat content of the animal. Both urinary and fecal salt concentrations varied with variations in dietary electrolytes. The principle method of maintaining salt balance seems to be through formation of relatively insoluble precipitated urinary K urate salts. This has the advantage of permitting the elimination of large quantities of ions with a relatively small water loss. Only a small quantity of water is produced by metabolism and a large proportion of water is lost in the feces. (Casey-Arizona)

W71-01286

FERTILIZATION OF THE GREGG VARIETY OF COTTON UNDER IRRIGATION AT THE NORTHEASTERN BRANCH STATION,

New Mexico State Univ., University Park; and New Mexico Agricultural Experiment Station, University Park.

For primary bibliographic entry see Field 03F.

W71-01287

LEAFLESS EUPHORBIA ON RAJASTHAN ROCKS, INDIA: I. ECOLOGICAL LIFE-HISTORY,

Jodhpur Univ. (India). Dept. of Botany.

David N. Sen.

Folia Geobotanica et Phytotaxonomica, Vol 2, No 3, p 1-15, 1968. 23 ref.

Descriptors: *Life history studies, *Xerophytes, *Arid lands, *Leaves, *Moisture deficit, Germination, Ecology, Environmental effects, On-site investigations, Plants, Drought resistance, Growth stages, Habitats, Limiting factors, Longevity, Microenvironment, Mortality, Persistence, Phenology, Plant morphology, Population, Flowering, Seasonal, Photoperiodism, Temperature, Seeds, Ecotypes.

Identifiers: *India, *Rajasthan Desert, *Euphorbs, *Phylloclades, Seedlings.

The 'leafless' spurge (*Euphorbia caducifolia*) is a phyllocladac xerophyte of Indian deserts which: (1) grows on rocks and gravelly habitats, (2) does not compete with other plants, (3) flourishes in conditions of extreme heat and water deficit, (4) is spiny and unpalatable to animals, (5) grows slowly, (6) slowly propagates through seeds which do not undergo dormancy, (7) bears leaves only during acute summer heat and water deficits, (8) germinates only in conditions of optimum light and temperature (25-30 deg. C.), (9) flowers in January and February and disperses seeds in March and April and (10) is much disturbed by man for fuel. The morphology and life history of the plant are described in detail. In florescence color indicates the existence of 2 differing genetic populations and these give rise to a variety of intermediates. The existence of genetic differences is reinforced by consistent differences in germination times of differing strains under the same environmental conditions. (Casey-Arizona) W71-01289

BIRDS OF A EUPHORBIA-ACACIA WOODLAND IN ETHIOPIA: HABITAT AND SEASONAL CHANGES,

Haile Sellassie I Univ., Addis Ababa (Ethiopia).

Edward W. Beals.

Journal of Animal Ecology, Vol 39, No 2, p 277-297, June 1970. 7 fig, 6 tab, 54 ref.

Descriptors: *Ecology, *Birds, *Vegetation, *Animal populations, *Rainfall, Climatic data, Trees, Shrubs, Animal behaviour, Xerophytes, Xerophilic animals, Semiarid climates, Tropical regions, Migratory birds, Non-migratory birds, Breeding, Nesting, Food habits, Competition, Environmental effects, Seasonal, On-site investigations, Plant groupings, Plant populations, Ecosystems, Habitats.

Identifiers: *Ethiopia, *Species diversity, *Thornscrub, Edge effect, Adaptability, Climbers.

The ecological dynamics of a species-rich tropical bird community were studied in a semiarid thorn woodland in Ethiopia. Trees, shrubs, subshrubs and climbers of the area were assayed for density and species richness. Heterogeneity was extremely high at the local level (100 square m.) providing for an 'edge effect'. There are 2 rainy seasons: a short one in April and a more extended period from June-October. Plants leaf and flower after the April rains and have another peak of flowering after the longer rains. Over 2 years, 102 species were observed and 37 of these nested in the area. The bird family and species diversities were characteristically high for tropical areas. Breeding densities were temporally staggered and were lowest during the rains and when transient non-breeding birds were present. It is tentatively concluded that the high bird species diversity may be explained by: (1) the patchy within-habitat plant species diversity created by shifts in intensity and time of rainy and dry seasons and (2) the relatively high behavioral adaptability as shown by the staggering of breeding seasons in response to environmental changes. (Casey-Arizona) W71-01292

PLANTING DATES FOR IRRIGATED GRAIN AND FORAGE SORGHUMS AT THE NORTHEASTERN BRANCH STATION,

New Mexico Agricultural Experiment Station, University Park.

For primary bibliographic entry see Field 03F.

W71-01293

MICROMETEOROLOGY AND ENERGY EXCHANGE IN TWO DESERT ARTHROPODS,

Arizona State Univ., Tempe. Dept. of Zoology.

Neil F. Hadley.

Ecology, Vol 51, No 3, p 434-444, Late Spring 1970. 8 fig, 27 ref.

Descriptors: *Microenvironment, *Micrometeorology, *Energy transfer, *Arid lands, *Xerophilic animals, Diurnal, Water loss, Variability, Deserts, Thermal capacity, Depth, Habitats, Data collections, On-site investigations, Ecology, Animal physiology, Burrows, Insects, Temperature, Solar radiation, Arizona, Albedo, Humidity, Evapotranspiration, Evaporation, Heat balance, Heat budget, Environmental effects, Mode of action, Moisture stress, Water balance, Climatic data, Animal behaviour, Convection.
Identifiers: *Arthropods, *Beetles, *Scorpions, *Subelytral cavity, Fossorial animals, Body temperature, Heat load, Thermocouples.

Surface climatic conditions were measured at an Arizona desert site and compared with arthropod burrow conditions at differing depths. Responses to climatic variations were also recorded in burrowed scorpions and surface beetles. High albedo, clear skies and high surface temperatures resulted in considerable reradiation of solar energy so that net radiation values are lower than those of many non-desert areas at the same latitude. When surface temperatures were compared with burrow temperatures it was found that when the surface was warm, 20-35 cm depths were cool, and vice-versa. Scorpion burrows at equal depths had daily relative humidity ranges of 55-70% while surface levels were less than 5%. Scorpions are able to escape both suboptimal high and low temperatures by vertical movement. The elytral temperatures of black beetles were measured at various surface temperatures. The animals were able to establish body thermal equilibria only under mild heat loads. Painting their dorsal surfaces slightly reduced elytral temperatures, but the significance of this is uncertain. Heat exchange budgets were calculated for the beetles and heat lost by convection equaled heat gained by radiation. The significance of the subelytral cavity in ventilation and water loss reduction is discussed. (Casey-Arizona) W71-01294

ECOLOGICAL EFFECT OF A CLAY SOIL'S STRUCTURE ON SOME NATIVE GRASS ROOTS,

South Dakota State Univ., Brookings. Dept. of Agronomy.

For primary bibliographic entry see Field 02G.

W71-01295

HELP FOR THE DESERT BIGHORN,

Utah Agricultural Experiment Station, Logan.

Lanny Wilson, Larry Farnsworth, and Lois M. Cox. Utah Science, Vol 29, No 2, p 34-36, June 1968. 3 photo.

Descriptors: *Sheep, *Water shortage, *Wildlife management, *Utah, *Animal populations, Watershed management, Arid lands, Water requirements, Competition, Grazing, Hunting, Big game, Limiting factors, Nutrient requirements, Springs, Colorado River.

Identifiers: *Desert bighorn sheep, *Range population, *Mineral deficiencies, *Population limit, Watering sites, Wingate Mesa (Utah), Green River (Utah), Game animals.

The rugged canyon country of southeastern Utah still harbors some of the most prized game animals on the North American continent, but their numbers have been decreasing since a 1776 report. Today desert bighorn sheep are rare along the Green and Colorado Rivers because they were pushed off ranges by domestic stock, subjected to diseases, wantonly killed, hunted by uranium miners and underwatered. In 1965 a study began to determine the habitats of the desert and mountain bighorn, their number and distribution and range conditions. The 1965-66 study made it clear that water supplies set the range population boundaries. Mineral deficiencies are a secondary limiting factor of population. The combination of mineral and water deficiencies particularly stress very young and very old individuals. It is recommended that 35 watering sites be developed in the Wingate Mesa and its canyons. (Popkin-Arizona)

Field 02—WATER CYCLE

Group 21—Water in Plants

W71-01298

PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,

New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 03C.
W71-01299

PERFORMANCE OF WINTER WHEAT VARIETIES UNDER DRYLAND AND IRRIGATED CONDITIONS, PLAINS BRANCH STATION, 1959-1966,

New Mexico Agricultural Experiment Station, University Park.
Ralph E. Finkner, David C. H. Hsi, and David B. Ferguson.
New Mexico Agricultural Experiment Station, Bulletin 524, April 1967. 9 p, 7 tab, 3 ref.

Descriptors: *Crop production, *Wheat, *Dry farming, *Irrigation effects, *New Mexico, Arid lands, Weight, Varieties, On-site tests.
Identifiers: *Crop performance, *Irrigated conditions, *Optimum yields, *Winter wheat, *Plains Branch Station (New Mexico), Tucumcari Irrigation Project (New Mexico), Irrigated crop, Dryland crop.

Winter wheat variety tests conducted from 1959 through 1966 at the Plains Branch Station, Clovis, New Mexico, included the varieties of Scout, Lancer, Winalta, Warrior, Tascosa and Cheyenne. Scout and Lancer produced the highest yields in four to five years of testing under irrigation. Tascosa, Winalta and Warrior had exceptionally high test weights. Sturdy, Caddo, Tascosa and Triumph were the shortest varieties in the irrigated tests. The highest yielding varieties under dryland conditions were Scout, Aztec and Cheyenne. All of these varieties have good to excellent milling and baking characteristics. Tables show yield properties and maturity rating of dryland and irrigated winter wheat varieties and monthly rainfall at the Station, 1959-66. (Popkin-Arizona)
W71-01396

FERTILIZATION OF IRRIGATED GRAIN SORGHUM, NORTHEASTERN BRANCH STATION,

New Mexico Agricultural Experiment Station, University Park.
David H. Williams, and Vernal H. Gledhill.
New Mexico Agricultural Experiment Station Bulletin 532, August 1968. 11 p, 5 tab, 2 fig.

Descriptors: *Fertilization, *Grains, *Sorghum, *Crop production, *Economic efficiency, Irrigation, Nitrogen, Phosphorous, Potassium, New Mexico, Arid lands, Data collections, Rates of application.
Identifiers: *Optimum yields, *Irrigated crops, *Regression response, *Net revenue return, *Northeastern Branch Station (New Mexico), Tucumcari Irrigation Project (New Mexico).

This four-year (1963-66) study was conducted because grain sorghum is one of the major crops grown on the Tucumcari Irrigation Project and producers lack information on optimum fertilizer applications. Yield response of NK-310 grain sorghum to nitrogen, phosphorous and potassium fertilizer applications and economic aspects of the responses were investigated. Nitrogen regression response on mean yield followed a quadratic equation with maximum yields at 213 pounds N. Maximum net returns from N at \$21.67 per acre occurred at 172 pounds N. Phosphorous response increased linearly for application rates. There was a constant net revenue return of \$0.19 per pound P up to 40 pounds P per acre. Combined N and P applications at the 172N-40P rate gave a yield of 5,887 pounds grain per acre, a net return over no fertilizer of \$29.25 per acre. Plants were irrigated to maintain favorable conditions. Tables show cultural and climatic conditions of experiments,

average yields under factorial fertilizer treatment, economic aspects, variance analysis and accumulated yields. Graphs of yields versus applied nitrogen and phosphorous are presented. (Popkin-Arizona)
W71-01397

GROWTH RATE OF WHEAT (TRITICUM AESTIVUM L., VAR. GAINES) AS A FUNCTION OF MOISTURE STRESS AND NITROGEN SUPPLY,

Oregon State Univ., Corvallis. Dept. of Soils.
Stephen Jimo Amujo.
M.S. Thesis, Oregon State University, 90 p, Submitted June 1970. 10 fig, 9 tab, 100 ref.

Descriptors: *Plant growth, *Moisture stress, *Nitrogen, *Soil moisture, *Wheat, Leaves, Osmotic pressure, Photosynthesis, Respiration, Growth rates, Growth chambers, Laboratory tests, Crop response, Soil-water-plant relationships, Root development, OWRR-001-ORE (7).
Identifiers: *Nitrogen deficiency, *Leaf area, *Dry matter production, Seedlings.

Crop production as determined by vegetative organ size is limited by both soil moisture and available N. These factors have differing effects on the growth rates and overall sizes of leaves and roots. Using a special constant moisture stress apparatus, the effects on wheat seedlings of 3 levels of moisture stress and 2 levels of N supply were studied with respect to: (1) rate of leaf area increase, (2) rate of dry matter increase and (3) total N content. With increasing available N, all 3 parameters increased due to more efficient photosynthesis, respiration and use of available water. With no N in the nutrient solutions, plant N contents decreased. Growth rates decreased with increasing moisture stress, the rate of decrease being greater between 0.35-1.00 bars than between 1.00-2.50 bars. Leaf area increase is more sensitive to N deficiency than to moisture stress. (Casey-Arizona)
W71-01398

COMPETITION FOR MOISTURE AMONG SEEDLINGS OF ANNUAL AND PERENNIAL GRASSES AS INFLUENCED BY ROOT ELONGATION AT LOW TEMPERATURE,

Washington State Univ., Pullman. Dept. of Forestry and Range Management.
Grant A. Harris, and A. M. Wilson.
Washington State University College of Agriculture scientific paper no. 3262. Supported in part by U.S. Department of Interior, Bureau of Land Management and Washington State University. Ecology, Vol 51, No 3, p 530-534, Late Spring 1970. 3 fig, 1 tab, 5 ref.

Descriptors: *Range grasses, *Competition, *Soil temperature, *Soil moisture, *Root development, Semiarid climates, Grama grasses, Wheatgrasses, Laboratory tests, Range management, Ecology, Soil-water-plant relationships, Grasses, Water utilization, Plant growth, Temperature, Vegetation establishment, Root systems.
Identifiers: *Seedlings, Perennial grasses, Annual grasses, Survival.

Seedlings of 2 important perennial species of wheatgrass, *Agropyron spicatum* (bluebunch wheatgrass) and *A. desertorum* (crested wheatgrass) often compete on western rangelands with 2 less desirable annuals, *Bromus tectorum* (Cheatgrass) and *Taeniatherum asperum* (medusahead). The competition often results in the hinderance of wheatgrass establishment. Roots of the annuals seem to grow faster at lower temperatures, leading to more efficient soil water utilization. Seedlings of all 4 species were grown in competition under differing temperature conditions. Cheatgrass, medusahead and crested wheatgrass roots penetrated the soil equally rapidly, remaining in favorable moisture conditions. Bluebunch wheatgrass roots were more slowly penetrating resulting in poor survival. In areas infested with these annuals, crested wheatgrass will therefore be more successful in competition. (Casey-Arizona)

W71-01399

ENVIRONMENTAL CHANGES AND THE ORIGIN OF AGRICULTURE IN THE NEAR EAST,

Minnesota Univ., Minneapolis. Dept. of Geology.
For primary bibliographic entry see Field 02B.
W71-01403

ON THE BIOLOGY OF THE DESERT TORTOISE TESTUDO SULCATA IN SUDAN,

Khartoum Univ. (Sudan). Dept. of Zoology.
J. L. Cloudsley-Thompson.
Journal of Zoology, London, Vol 160, No 1, p 17-33, March 1970. 6 fig, 3 tab, 24 ref.

Descriptors: *Reptiles, *Water conservation, *Water balance, *Life history studies, *Ecology, Arid lands, Transpiration, Evaporation, Heat resistance, Animal behavior, Xerophilic animals, Physiological ecology, Environmental effects, Drought tolerance, Food habits, Reproduction, Seasonal, Cooling, Animal metabolism, Water loss, Biorhythms, Temperature, Diurnal, Urine, Growth rates, Turtles.
Identifiers: *Tortoises, *Behavioral thermoregulation, *Africa, *Circadian rhythms.

Desert tortoises are widely distributed in arid and semiarid regions of Africa south of the Sahara. Seven specimens were captured in the Khartoum area and allowed to reproduce. The food habits, growth, water and heat control mechanisms and circadian rhythms of the offspring were studied. Copulation is most frequent after the rains have ended. A non-linear relationship obtains between length and weight and individuals vary widely in growth rate, tending to cluster in spaced groups. The animals survive indefinitely without water if fed green succulents. Younger animals probably have higher metabolic rates and this is reflected in their transpirational water loss which is mainly pulmonary. About half the water loss in adults occurs through cutaneous transpiration. Urine volume is a direct function of both temperature and food intake. Thermal regulation is primarily behavioral. When the temperature reaches 40-41 degrees C., the animals wet their heads, necks and forelegs by copious salivation which in turn produces evaporative cooling. This reaction is a heat response and is not photoactivated. There is a 24-hr circadian rhythm which cannot be reset by interposed 3-hr light or dark periods. (Casey-Arizona)
W71-01404

HYGROSCOPIC ADDITIVES TO PHENOXY HERBICIDES FOR CONTROL OF SALT- CEDAR,

Agricultural Research Service, Los Lunas, N. Mex. Crops Research Div.
For primary bibliographic entry see Field 03B.
W71-01405

NON-AUTOTROPHIC CARBON DIOXIDE METABOLISM IN CACTI,

California Univ., Riverside. Dept. of Life Sciences; and California Univ., Riverside. Dry-Lands Research Inst.
Irwin P. Ting, and W. M. Dugger, Jr.
Botanical Gazette, Vol 129, No 1, p 9-15, March 1968. 7 fig, 6 tab, 22 ref. NSF Grant GB2547.

Descriptors: *Carbon dioxide, *Cacti, *Xerophytes, *Organic acids, *Physiological ecology, Stomata, Water conservation, Arid lands, Laboratory tests, Radiochemical analysis, Plant physiology, Light, Photosynthesis, Respiration, Carbohydrates, Metabolism, Mode of action, Photoactivation, Amino acids, Nocturnal, Diurnal, Desert plants, Hydrogen ion concentration, Acids, Data collections, Chromatography.
Identifiers: *Assimilation, *Carboxylation, Non-autotrophic, Carbon-14.

Earlier data indicating significant levels of nighttime carbon dioxide uptake in crassulacean

succulents have been interpreted as a plant water conservation mechanism due to daytime stomatal closure. Native cacti (*Opuntia ramosissima*) were kept in environmentally controlled chambers, subjected to alternating light-dark periods and incubated with C-14 in order to study the process of non-autotrophic carbon dioxide assimilation. Most of the tagged non-autotrophically ('dark') assimilated carbon dioxide appeared in organic acids (primarily malic acid) or amino acids. After daytime assimilation, some C-14 appeared in carbohydrates with slightly less in malic acid, indicating that the available amount of carbon dioxide is a limiting factor. The half-life of C-14 in organic acids is 408 min in the dark and 2,980 min in the light. Apparently malic acid accumulates and turns over at a rapid rate and its level at anytime is due to relative rates of carboxylation and decarboxylation. In both dark and light, C-14 release can be described by 2 first order equations. It is felt that the phenomenon of rapid turnovers does not support correlation with stomatal closures. Probably dark assimilation functions in part as a nucleotide rearrangement mechanism. (Casey-Arizona) W71-01406

SOIL MOISTURE AND EFFECTIVENESS OF PREEMERGENCE HERBICIDES,

Illinois Univ., Urbana; and Danville Junior Coll., Ill.
R. L. Stickler, E. L. Knake, and T. D. Hinesly.
Weed Science, Vol. 17, No. 2, April 1969, p 257-259, 3 fig, 9 ref.

Descriptors: *Soil moisture, *Pre-emergents, *Herbicides, *Weed control, *Brush control, Plant growth regulators, Arid lands, Efficiencies, Moisture retention.
Identifiers: Herbicide efficiency, *Foxtail, Atrazine, EPTC, Amiben, Trifluralin, Propachlor, Methoxymethyl, CP 50144.

Rainfall or irrigation generally has been considered of importance for most preemergence herbicides to be effective. The relation between soil moisture and the effectiveness of preemergence herbicides for control of giant foxtail (*Setaria faberii* Herrm.) was studied under greenhouse conditions using surface soil from Drummer silty clay loam with 25, 31 and 27 percent moisture. Herbicides used were 2-chloro-4 ethylamino-6-isopropylamino-s-triazine (atrazine); ethyl N, N-dipropylthiocarbamate (EPTC); 3-amino-2, 5-dichlorobenzoic acid (amiben); alpha, alpha, alpha-trifluoro-2, 6-dinitro-N, N-dipropyl-p-toluidine (trifluralin); 2-chloro-N-isopropylacetanilide (propachlor); and 2-chloro-N-(methoxymethyl)2 prime, 6 prime diethyl-acetanilide (CP 50144). The effectiveness of atrazine and EPTC was increased when soil moisture was raised from 25 to 31 percent, but no further increase was obtained at 37 percent. Response to amiben and trifluralin increased linearly. Increasing moisture within this range had little effect on propachlor and CP 50144. Graphs of percent moisture versus soil tension, reduction in dry weight of different herbicides, and change in moisture in days are given. (Popkin-Arizona) W71-01409

VASCULAR AQUATIC PLANTS FOR MINERAL NUTRIENT REMOVAL FROM POLLUTED WATERS,

Savannah River Ecology Lab., Aiken, S.C.
Claude E. Boyd.
Economic Botany, Vol 24, No 1, p 95-103, 1970. 1 fig, 4 tab, 31 ref. AEC AT (38-1)310.

Descriptors: *Water pollution, *Aquatic plants, *Inorganic compounds, *Nutrients, Vascular tissues, Eutrophication, Standing crop, Effluents, Fertilizers, Herbicides, Alligatorweed, Water hyacinth, Phytoplankton, Growth rates, Cattails, Productivity, Chemical analysis, Proteins, Sewage treatment, Nitrogen, Phosphorus, Ponds, Feeds, Mosquitoes, Insecticides, Viruses.
Identifiers: *Vascular aquatic plants, Forage, Eichhornia crassipes, Alternanthera philoxeroides, Pistia stratiotes, Typha latifolia.

Aquatic plants have potential for nutrient removal and use as feedstuffs but economics of harvesting and processing would prohibit their direct utilization as a forage in technologically advanced nations. Nutrient removal systems based on the harvest of aquatic plants have potential application in removing nutrients from effluents and natural waters. Large quantities of all elements essential for plant growth would be removed in proportion to the compositional ratios of particular species. Harvested plants could be used as forage to offset partially cost of nutrient removal. Where practicable, such systems would turn excessive nutrients into fertilizers to increase aquatic plant production, and the economics of nutrient pollution abatement would be enhanced. Attention should be given to the possibility of pathogen (particularly virus) transfer from waste water to plants to animals to humans—most critical with municipal sewage. The unsuitability of feedstuffs from plants grown on certain wastes would not preclude the use of plants for nutrient removal or as green manures. The plants should be used as feedstuff, when possible, since green manures are of very low economic value. (Jones-Wisconsin) W71-01487

2J. Erosion and Sedimentation

COMPOSITIONAL VARIATION IN PACIFIC OCEAN FERROMANGANESE NODULES AND ITS RELATIONSHIP TO SEDIMENT ACCUMULATION RATES,
Edinburgh Univ. (Scotland). Grant Inst. of Geology.
For primary bibliographic entry see Field 02K.
W71-01101

THE OCCURRENCE AND GEOLOGIC WORK OF RIP CURRENTS OFF SOUTHERN CALIFORNIA,
University of Southern California, Los Angeles. Dept. of Geological Sciences.
David O. Cook.
Marine Geology, Vol 9, No 3, p 173-186, October 1970. 14 p, 6 fig, 1 tab, 18 ref. ONR Contract NR 083-144.

Descriptors: *Rip currents, *Sedimentation, *California, Waves (Water), Scour, Beach erosion, Sediment transport, Sands, Tides, Tidal effects, Currents (Water), Surf, Open channel flow.
Identifiers: Southern California, Redondo Beach (Calif).

An investigation of the occurrence of rip currents in southern California revealed that the development of these features is influenced by wave conditions, beach morphology, tidal level, and wind. The largest rips are formed during periods of intense wave activity. At Redondo Beach, rip currents selectively remove fine sand and mineral with a low specific gravity from the beach. Large rips transport significant quantities of sediment to the inner continental shelf. Rip current channel deposits are sedimentary structures which may aid in reconstructing paleoshorelines. (Knapp-USGS) W71-01102

SOURCES AND DISTRIBUTION OF SUSPENDED SEDIMENT IN NORTHERN CHESAPEAKE BAY,
Maryland Dept. of Research and Education, Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 02L.
W71-01103

INDETERMINATE HYDRAULICS OF ALLUVIAL CHANNELS,
Geological Survey, Tucson, Ariz.
Thomas Maddock, Jr.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7696, p 2309-2323, November 1970. 15 p, 5 fig, 15 ref, append.

Descriptors: *Alluvial channels, *Channel morphology, *Sediment transport, *Sedimentary structures, *Channel erosion, Hydraulics, Discharge (Water), Sediment discharge, Open channel flow, Regime, Fluid friction.
Identifiers: Open channel hydraulics.

Field and laboratory data indicate that the relations among width, depth, velocity, and slope of alluvial channels are indeterminate unless the constraints on the development of the bed forms are known. A knowledge of the rate of sediment transport will usually satisfy this deficiency. Only a full knowledge of the response of one variable to changes in other variables will permit an evaluation and description of the relation of all the variables to each other. It is possible to predict general patterns of stream behavior. Actual stream behavior deviates about these general patterns in two ways. One is a statistical deviation expected when dealing in probabilities. The second results from a change in the general or usual relation between discharges of water and sediment and size of transported sediment. Because it is impossible to have an alluvial channel that will remain in equilibrium under a wide range of discharges of water and sediment, problems associated with alluvial channels can and must be resolved only by compromise. (Knapp-USGS) W71-01110

AN EXPERIMENTAL STUDY OF SUBMARINE SAND BARS.
Corps of Engineers, Washington, D.C. Beach Erosion Board.

Available from NTIS as AD-701 197, \$3.00 in paper copy, \$0.95 in microfiche. 1970. 39 p. Technical Report No. 3.
Identifiers: *Ocean waves, *Sand, *Beaches, Erosion, Transport properties, Motion, Mathematical analysis, Beach erosion, *Sand bars, Sand ripples.

The paper reports the results of experiments made to determine the existence of basic relationships governing sand bar phenomena. Observations were made of the form, dimensions, and number of bars; wave characteristics; ripple formation; and nature and volume of sand movement involved in bar phenomena.
W71-01128

GEOGRAPHY PROGRAMS, OFFICE OF NAVAL RESEARCH,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 02L.
W71-01163

EROSION PROTECTION FOR THE OUTLET OF SMALL AND MEDIUM CULVERTS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 04A.
W71-01173

TIDAL FLAT SEDIMENTATION AT COOLEY LANDING, S. W. SAN FRANCISCO BAY,
Stanford Univ., Calif.
For primary bibliographic entry see Field 02L.
W71-01175

ESTIMATION OF RIVER BED AGGRADATION DUE TO A DAM,
Public Works Research Inst., Tokyo (Japan).
Akihiko Tsuchiya, and Katsuyoshi Ishizaki.
In: Proceeding 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 297-304, 1969. 8 p, 3 fig, 1 ref.

Descriptors: *Aggradation, *Dams, *Sedimentation, *Sediment transport, Streams, Sediment load, Mathematical studies, Simulation analysis, Sand waves, Dunes.

Field 02—WATER CYCLE

Group 2J—Erosion and Sedimentation

Identifiers: Japan.

A method for estimating river bed aggradation due to the construction of dams in torrential rivers is developed. The basic equation, which shows the degradation and aggradation of river beds, is developed from the condition of continuity and the discharge relation of bed load. Application of the equation to the Joganji River at the Hongu Dam, Japan shows a good agreement between calculated and observed data. A graph shows the height of aggradation with the change of time and distance. (Knapp-USGS)
W71-01214

PHYSICOCHEMICAL CONDITIONS OF DEPOSITION OF BACILLARIOPHYTA IN DAVIS LAKE, KLAMATH AND DESCHUTES COUNTIES, OREGON, U.S.A.,
Northeast Louisiana State Coll., Monroe. Dept. of Biology.
For primary bibliographic entry see Field 02H.
W71-01288

SELF-STABILIZING TENDENCIES OF ALLUVIAL CHANNELS,
Colorado State Univ., Fort Collins.
J. Gessler.
Proc Amer Soc Civ Eng, J Waterways Harbors Div, Vol 96, No WW2, p 235-249, May 1970. 15 p, 5 fig, 1 tab, 5 ref, 3 append.

Descriptors: *Alluvial channels, *Stable channels, Stabilization, Channels, *Channel erosion, Erosion, *Grain sizes, Hydrology, Sediment transport, Hydraulics, Stability, Alluvium, Streambeds, Degradation (Stream).
Identifiers: *Armoring (Streambed, *Stability coefficient.

Channels constructed in coarse alluvial material tend to develop an armor coat at the surface of the bed, protecting the material beneath the top layer from further erosion. A method is outlined for predicting the grain size distribution curve of such a self-stabilized armor coat and the eroded material. Based on the results, the minimum amount of material to be eroded prior to development of a stable condition resulting from armoring can be estimated. An attempt is made to determine those conditions which result in a finally stable bed. This leads to a design criterion for stable channels constructed in coarse, non-uniform alluvial material. The design criterion integrates the stabilizing influence of all grain sizes present in a self-stabilized armor coat and permits operating the channel at a present factor of safety. (USBR)
W71-01308

DISTRIBUTION OF ARSENIC IN UNCONSOLIDATED SEDIMENTS FROM SOUTHERN LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05A.
W71-01325

WATERSHED MANAGEMENT AND SOIL EROSION PROBLEMS IN WEST PAKISTAN,
Muhammad Ishaq.
Pakistan Journal of Science, Vol 20, No 5 and 6, p 234-256, September-November 1968. 10 tab, 10 ref.

Descriptors: *Watershed management, *Reservoirs, *Soil erosion, *Floods, *Sediment load, Reforestation, Planning, Arid lands, River basins, Soil conservation, River basin development, Population, Water conservation, Water distribution (Applied), Water policy, Water resources, Erosion, Dams, Sedimentation, Silting, Grazing, Data collections, Livestock.
Identifiers: *West Pakistan, Overgrazing.

Although a number of reservoirs have been built in the major river basins of West Pakistan, the problems of flooding and sedimentation buildup

have been critical, particularly in view of their impact on food production in an underdeveloped country. The problems are stated and clarified and a number of measures designed to abate these problems are reviewed. These measures include: (1) an estimate of river sedimentation loads, (2) a review of dam projects, (3) projected reforestation and other soil conservation measures and (4) an analysis of the magnitude of soil conservation problems. It is concluded that the basic problem is rooted in pressures of human over-population on available resources and their resulting restrictions on long term conservation projects. (Casey-Arizona)
W71-01400

KNIGHT V ROGERS (TITLE DISPUTE TO ACCRETIONS IN NAVIGABLE RIVER).
For primary bibliographic entry see Field 06E.
W71-01584

ISELIN V LA COSTE (TITLE TO ACCRETIVE LANDS).
For primary bibliographic entry see Field 06E.
W71-01598

WEST PENN RY V UMBEL (PROPERTY DAMAGE RESULTING FROM ROCK SLIDE; NEGLIGENT CONTAINMENT OF WATER).
For primary bibliographic entry see Field 06E.
W71-01601

PLATTSMOUTH BRIDGE CO V GLOBE OIL AND REFINING CO (OWNERSHIP OF ACCRETIVE LANDS).
For primary bibliographic entry see Field 06E.
W71-01613

2K. Chemical Processes

COMPOSITIONAL VARIATION IN PACIFIC OCEAN FERROMANGANESE NODULES AND ITS RELATIONSHIP TO SEDIMENT ACCUMULATION RATES,
Edinburgh Univ. (Scotland). Grant Inst. of Geology.
N. B. Price, and S. E. Calvert.
Marine Geology, Vol 9, No 3, p 145-171, October 1970. 27 p, 9 fig, 3 tab, 96 ref.

Descriptors: *Diagenesis, *Bottom sediments, *Pacific Ocean, *Manganese, Organic matter, Sedimentation, Sediments, Water chemistry, Oxidation-reduction potential, Oxidation, Reduction (Chemical), Mud-water interfaces, Sediment-water interfaces.
Identifiers: Manganese nodules.

Recent work on the geochemistry of deep- and shallow-water manganese nodules and the post-depositional migration of manganese and related metals in marine sediments emphasizes the role of diagenesis in the formation of manganese nodules and concretions. The Mn/Fe ratio in Pacific Sea floor nodules is highest along the eastern margin and lowest in the southwest central region. The Fe/Co and Mn/Ni ratios are also highest in the eastern Pacific but lowest in the north and south central Pacific. The enrichment of Mn in marginal nodules is caused by the diagenetic migration of Mn within the Recent sediments and its precipitation at the sediment surface. The Mn/Fe ratio is therefore a useful index of diagenetic derivation of metals in nodules. The depletion of minor metals in marginal nodules, in spite of an adequate source, must similarly be controlled by diagenetic processes within the sediments. Since diagenesis is largely governed by the organic matter in sediments and this depends on the rate of sediment accumulation, diagenesis is most marked in marginal, rapidly accumulating sediments and minimal in open oceanic sediments. The regional variations in nodule composition therefore reflect the broad pat-

tern of sedimentation in the Pacific. (Knapp-USGS)
W71-01101

THE DIELECTRIC RELAXATION SPECTRA OF WATER, ICE, AND AQUEOUS SOLUTIONS AND THEIR INTERPRETATION. VIII. TRANSFER OF PROTONS THROUGH 'PURE' ICE I (h) SINGLE CRYSTALS. I. POLARIZATION AND CONDUCTION. III. EXTRINSIC-VERSUS INTRINSIC POLARIZATION: SURFACE VERSUS VOLUME CONDUCTION,
Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.
For primary bibliographic entry see Field 01B.
W71-01127

THE EFFECTS OF SURFACE PROPERTIES OF WATER ON EVAPORATION AND CONDENSATION,
Rochester Inst. of Tech., N.Y.
Kenneth Hickman, Jer Ru Maa, Peter J. Harris, and Andrew Davidhazy.
For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price \$1.25 per copy. Office of Saline Water Research and Development Progress Report No 585, December 1970. 124 p, 42 ref. OSW Grant 14-01-0001-2119.

Descriptors: *Air-water interface, *Condensation, *Mass transfer, *Evaporation, *Boule flotation, Desalination, Distillation, Films, Surfaces.
Identifiers: Surface purification, Boules, Transfer coefficients.

Some of the many resistances which determine the rate of interchange between a liquid and its vapor were investigated. It was found that transport across new, clean liquid interfaces is dependent only on the gas laws and not on the chemistry of the fluids, and that the lowered transport in stagnant fluids is not wholly determined by physical factors but is also by impurities that happen to be present. To study new clean surfaces the authors have followed Rayleigh's classic advice to observe them as they emerge from an orifice. Jet tensimeters which expose moving streams of liquid for very short periods, A.02 sec., have been the principal instruments of the investigation. The present report considers the quest for purer water in the glass boulemaker and examines the change of behavior of boules floating on that water when various contaminants, notably the long chain fatty acids and alcohols are added. Similar effects have been recorded in the absence of boules by measuring superheat only. The authors noted repeatedly an increase in the superheat of a body of water on the addition of one molecule of a particular fatty acid to each 80 x 1,000,000 molecules of water. Finally, a new study was made of the schizoid evaporating surface, which is a special example of Langmuir twitching. Although the condition can be induced on water only transiently and with great difficulty, it is relevant to the study of water because contaminants influence surface movements in both cases and both can be induced by the stored energy of momentum. (Leiserson-Office of Saline Water)
W71-01198

MANGANESE IN SMALL FLOOD RETARDING IMPOUNDMENTS, WEST CENTRAL ARKANSAS,
Soil Conservation Service, Fort Smith, Ark., and Quachita Baptist Univ., Arkadelphia, Ark.
Patrick Burke, and J. Nix.
Typescript Report (1970) 11 p, 9 fig, 3 tab, 16 ref. OWRR Project No A-999-ARK.

Descriptors: *Dissolved oxygen, *Manganese, *Water quality, *Reservoirs, Thermal stratification, Turnover, Water circulation, Thermocline, Arkansas, Water chemistry, Oxidation, Mixing.
Identifiers: Stratified reservoirs.

The distribution of dissolved oxygen and manganese was studied in six flood-water retarding impoundments in West Central Arkansas. This impoundments were observed to be in a stratified condition from June through September. Oxygen depletion, accompanied by a buildup of manganese, was observed in the lower portions of these impoundments. During periods of large inflow into the impoundments, the dissolved oxygen generally increased, accompanied by a decline in the manganese concentration. (Knapp-USGS)
W71-01207

SALT-FERTILIZER-SPECIFIC ION INTERACTIONS IN SOIL,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 03C.
W71-01283

DISTRIBUTION OF MERCURY IN NATURAL WATERS OF THE SOUTHERN SLOPE OF NORTHWESTERN CAUCASUS (IN RUSSIAN),
Severo-Kavkazskogo Geologicheskogo Upravleniya, Laurskaya Gidrogeologicheskaya Psartiya.
For primary bibliographic entry see Field 05B.
W71-01481

2L. Estuaries

SOURCES AND DISTRIBUTION OF SUSPENDED SEDIMENT IN NORTHERN CHESAPEAKE BAY,
Maryland Dept. of Research and Education, Solomons. Chesapeake Biological Lab.
R. B. Biggs.
Project partly financed by Corps of Engineers. Marine Geology, Vol 9, No 3, p 187-201, October 1970. 15 p, 5 fig, 5 tab, 12 ref. Bureau of Sport Fisheries and Wildlife Contract 14-16-0005-2096.

Descriptors: *Suspended load, *Seston, *Estuaries, *Provenance, Sedimentation, Runoff, Erosion, Oxidation, Organic matter, Silts, Clays, Currents (Water), Waves (Water), Sedimentation rates, Water chemistry.
Identifiers: Chesapeake Bay, Sediment budget.

Sources and losses of total suspended matter (seston) and organic carbon are identified and estimated for northern Chesapeake Bay. Suspended matter in the northernmost segment of the Chesapeake is dominated by a fluvial source with a significant contribution from shore erosion. About 23% of the total input of particulate material is lost from the northernmost section, but only 4% escapes downstream while 19% is organically oxidized within the area. The nominal sedimentation rate for the northern bay is 3.7 mm/year. The middle section of the Chesapeake is dominated by sources of suspended matter from shore erosion and phytoplankton production. Approximately 41% of the total mass of suspended matter is lost from the middle Chesapeake; 23% of the total input to the middle bay is lost downstream, while an additional 18% is organically oxidized. Nominal sedimentation for the middle bay is 1.1 mm/year. (Knapp-USGS)
W71-01103

CARBON-14 AGES RELATED TO OCCURRENCE OF SALT WATER,
Geological Survey, Washington, D.C.
William Back, Bruce B. Hanshaw, and Rubin Meyer.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7702, p 2325-2336, November 1970. 12 p, 8 fig, 2 tab, 12 ref. Grant ARO-5839-EN.

Descriptors: *Saline water intrusion, *Ground-water movement, *Withdrawal, *Radioactive dating, South Carolina, Carbon radioisotopes,

Tracers, Chlorides, Hydrogeology, Recharge, Pumping, Water resources development.
Identifiers: *Hilton Head Island (SC).

Under native conditions in Hilton Head Island, S. C., the original regional flow path was generally from the south end to the north end of the island. At the south end, the fresh water (less than 35 mg per 1 chloride content) is older than 22,000 yr. In the central and higher part of the island, the age of the fresh water ranges from about 2,000 yr to 12,000 yr. This age range is interpreted to mean that with a lowering of regional head, owing to heavy pumping in the Savannah, Ga., area, regional flow has reversed, and recharge is being induced into the aquifer in this area. In the central part of the island, the deeper contaminated zone (chloride content about 1,500 mg per 1) has an age of about 26,000 yr B.P. In the northern part of the area, water of the same chloride content has an age of about 7,000 yr B.P. In this study, therefore, radiocarbon concentrations show: (1) The effects of reversal of flow; (2) the area of resultant recharge; (3) the area of modern ocean-water encroachment; and (4) the area of contamination by saline formation water. (Knapp-USGS)
W71-01107

ECOLOGICAL STUDIES OF MARINE PLANKTON,
TRW Systems Group, Redondo Beach, Calif. Physical Research Center.
Vakula S. Srinivasan, and Herbert P. Silverman.
Available from NTIS as AD-702 499, \$3.00 in paper copy, \$0.95 in microfiche. Rept no. 07966-6002-R000. Final Report, February 70. 29 p.
Identifiers: *Ecology, Plankton, *Plankton, Stereoscopic photography, Marine biology, Recording systems, Lasers, Illumination, Optical equipment, Holography.

Holographic techniques for the ecological study of marine plankton were examined. Holocamera design, laser illumination sources and recording emulsion requirements were investigated. Exploratory work on phototactic responses of marine organisms and holographic moves for the locomotion of copepods were performed. Image reduction techniques for the study of large volumes were investigated. A technique for recording large volume scenes was successfully demonstrated.
W71-01125

ORGANIZATION AND DISTRIBUTION OF PHOTOPLANKTON COMMUNITIES,
Instituto de Investigaciones Pesqueras, Barcelona (Spain).
Ramon Margalef.
Available from NTIS as AD-702 468, \$3.00 in paper copy, \$0.95 in microfiche. Final Technical Report, January 30, 1970. 14 p. ONR Contracts Nonr-3447 (00), N62558-4287, F61052-67-C-0013.
Identifiers: *Plankton, Distribution, *Ecology, Plankton, Sampling, Chemical analysis, Quantitative analysis, Population, Measurement, Statistical analysis, Nutrition, Light, Organic pigments, Marine biology, Sea water, Hydrographic surveying, Spain, *Phytoplankton.

The different measurements of environmental factors or of phytoplankton populations, obtained in different points of a volume of water, can never be considered as random samples of a uniform statistical universe. It is more appropriate to study distributions as dependent of position in space and, as manifestations of an 'organization'. The density of one given species in a small volume of water is not only a function of local environmental properties, but also depends on the concentration of the same species in some neighboring area. Diffusivity and water turbulence is very important, as are the gradients and generated flows. Patches of strongly stratified water, poor in nutrients is another unit of reference. A careful consideration of the distribution of phytoplankton advises a change in the order of importance given to the different factors. Salini-

ty and temperature have been often considered as very important factors in plankton distribution, but from recent evidence turbulence and nutrient contents are, besides light, the chief factors in explaining phytoplankton populations. It was discovered that not only total amount of plant pigments, but also relative concentration of pigments could be meaningful. Pigment ratios could be substituted, in the practice, by ratios between absorbancies at given wavelengths of the pigment extracts. Thus, progress in plant physiology emphasizes the idea that the diversity of pigments is an expression of properties of the photosynthesizing apparatus, and that the said pigment ratios, besides any taxonomical interpretation, have implications of true ecological relevance concerning the degree of evolution or the stage of succession.
W71-01132

AN OCEANOGRAPHIC SURVEY OF THE COASTAL WATERS BETWEEN SAN FRANCISCO BAY AND MONTEREY BAY, CALIFORNIA,
Naval Postgraduate School, Monterey, Calif.
Peter Stephen Labyak.
Available from NTIS as AD-703 645, \$3.00 in paper copy, \$0.95 in microfiche. Master's thesis, October 1969. 316 p.
Identifiers: *Sea water, Optical properties, Underwater sound, Sound transmission, Temperature, Salinity, Density, Oxygen, Phosphates, Nitrogen compounds, Hydrographic surveying, Bathymograph data, Theses, Monterey Bay, San Francisco Bay, Littoral drift, Upwelling, *Optical oceanography.

A detailed oceanographic survey of the coastal waters between Monterey Bay and San Francisco Bay, California, was conducted from 10 through 18 May 1969. Measurements of beam transmittance, sound velocity, temperature, and particulate count were obtained. Over 500 water samples were taken for particulate analysis. The optical properties of this region were found to be very complex. The waters appeared to be affected by flow from San Francisco Bay, littoral material, upwelling, and possibly sewage outfalls during the survey. A greater volume of water with low transmissivity and high particle count existed in the northern region of the survey area than in the southern region. An eddy system between Monterey Bay and Point Año Nuevo was suggested. Approximately 90 percent of the particles affecting beam transmittance were less than 12 microns in diameter. Particle sizes were found to decrease with increased depths. A fairly good correlation of beam transmittance with particle count was observed except in near shore areas.
W71-01152

REMOTE SENSING OF COASTAL WATERS USING MULTISPECTRAL PHOTOGRAPHIC TECHNIQUES,
Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
For primary bibliographic entry see Field 07B.
W71-01162

GEOGRAPHY PROGRAMS, OFFICE OF NAVAL RESEARCH,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
W. G. McIntire.
Available from NTIS as AD-705 130, \$3.00 in paper copy, \$0.95 in microfiche. Final rept., 15 Mar 59 - 31 Mar 70, April 15, 1970. 78 p. Contract Nonr-1575 (03).
Identifiers: *Naval research, Seacoast, *Seacoast, Reports, Tropical cyclones, Coral reefs, Swamps, Avalanches, Beaches, Rock (Geology), Abstracts, Sedimentation, Plants (Botany), Ecology, Ice islands, Geologic age determination, Rivers, Deltas, Louisiana, Beach erosion, Seacoast protection, Coastal environment, Atolls, Geomorphology, Reefs.

The Final Report covers research on Geography Programs, Office of Naval Research, covering the period March 15, 1959, through March 31, 1970. The present program is interdisciplinary in scope, involving three major categories of coastal investigation: coastal environments, coastal dynamics, and coastal information management and model simulation. This activity and the orientation are relevant to user needs. The abstracts of publications presented in this report as listed sequentially by Technical Report numbers. A small section listing reports in press and one outlining those in the miscellaneous category complete the report.
W71-01163

A VARIABLE-BOUNDARY NUMERICAL TIDAL MODEL.

Alaska Univ., College. Inst. of Marine Science. John C. Mungall, and J. Brian Matthews. Available from NTIS as AD-705 610, \$3.00 in paper copy, \$0.95 in microfiche. March 1970, 157 p. Report Number R70-4.
Identifiers: *Estuaries, Tides, *Tides, Boundary value problems, Mathematical models, Computer programs, Inland waterways, California, Cook Inlet, Gulf of California, Fiord inlets.

A numerical tidal model using equations developed by Hansen (1952) and Yuen (1967) is automated to the point where the potential user need not undertake extensive reprogramming. The user adds to the program only those cards needed to specify tides at input points as a function of time; the application of the relevant calculations at each grid point being controlled by an integer matrix that corresponds to the inlet boundary. A sample problem is covered in detail and applications of the model to the M2 tide of the Gulf of California and to a hypothetical mean tide in Cook Inlet are shown.
W71-01167

SEASONAL PHENOMENA IN THE PLANKTON OF THE LABRADOR SHELF, THE GRAND BANK OFF NEWFOUNDLAND AND FLEMISH CAP.

Naval Oceanographic Office, Washington, D.C. For primary bibliographic entry see Field 021.
W71-01168

TIDAL FLAT SEDIMENTATION AT COOLEY LANDING, S. W. SAN FRANCISCO BAY, Stanford Univ., Calif.

Raymond Pestrong. Available from NTIS as AD-702 059, \$3.00 in paper copy, \$0.95 in microfiche. Stanford Univ Technical Report 1969, 55 p. ONR Contract Nonr-4430 (00).
Identifiers: *Bays, Sedimentation, Mud, Floods, Erosion, Transport properties, Sampling, Clay, Silt, Sand, Drainage, Grasses, Radiography, Aerial photography, Water pollution, California, San Francisco Bay, Tidal marshes, Levees, Mud flats.

Tidal marsh and mud flat sedimentation is being studied on portions of the southwestern side of San Francisco Bay. Sediments transported and deposited within this low energy environment are distributed in accordance with a principle of scour and settling lag proposed for sediments in the North Sea. The finer sediments are concentrated nearer the higher portions of the tidal flats and marshes where lower ebb flow velocities are unable to transport them farther bayward. Greater quantities of bedload sediment are moved on the flood than on the ebb portions of the tidal cycle both on the tidal flat and through the marsh channel system. A sediment budget is maintained within the tidal marshes, whereby the growth of the tidal channels accompanies the extension of the marsh onto the tidal flat. This development is documented on aerial photographs taken during a six-year period. Higher shear strengths and densities are displayed by the slightly elevated tidal channel levees than are present for the adjacent mud flats because of the longer periods of desiccation the levees ex-

perience. X-radiologic studies of near-surface tidal flat mud slabs show sedimentary structures not apparent in photographs, and suggest penecontemporaneous deformation of the muds.
W71-01175

NUMERICAL COMPUTATION OF FULLY STRATIFIED FLOW,

Waterloopkundig Laboratorium, Delft (Netherlands). C. B. Vreugdenhil.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 37-44, 1969. 8 p, 3 fig, 5 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Tidal effects, *Mathematical models, *Mixing, Turbulent flow, Critical flow, Streamflow, Hydraulics, Stratified flow, Tides, Water level fluctuations, Currents (Water), Unsteady flow.
Identifiers: Netherlands.

A numerical method was used to calculate the dynamic behavior of a salt wedge in an estuary, as influenced by tidal conditions. Salt and fresh layers are assumed not to mix; the technique, however, can be used also with mixing. A major physical difficulty is the occurrence of supercritical flow at the seaward end of the estuary. A solution is given for a case in which this difficulty does not occur. (Knapp-USGS)
W71-01238

EXPERIMENTAL AND THEORETICAL MODELING OF SALINE WEDGES,

Tokyo Inst. of Tech. (Japan). Dept of Civil Engineering.

Hiroyoshi Shi-Igai, and Masaki Sawamoto. French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 29-36, 1969. 8 p, 10 fig, 7 ref.

Descriptors: *Saline water intrusion, *Estuaries, *Mixing, Hydraulic models, Streamflow, Tidal effects, Water level fluctuations, Tides, Mathematical studies, Equations, Water quality, Salinity.
Identifiers: Japan.

The intrusion length of saline wedges in weakly mixing estuaries was computed in nondimensional form. Model tests were also made for strong mixing rivers. Ultrasonic vibrators were used to obtain a strong mixing condition in the laboratory. Mixing phenomena are reproduced in the smaller channels fairly well. (Knapp-USGS)
W71-01239

COMPUTATIONS OF TIDAL PROPAGATION WITH REFERENCE TO TAN-SHUI RIVER,

Chang-ling Liu.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 21-28, 1969. 8 p, 4 fig.

Descriptors: *Tides, *Estuaries, *Mathematical models, Water level fluctuations, Floods, Flood forecasting, State-discharge relations, Frequency analysis, Fourier analysis, Tidal effects, Digital computers.
Identifiers: Taiwan.

Computation of tidal propagation is based on the equation of motion, in which the frictional effect is dominant in shallow rivers. The equation can be linearized, because the resistance force itself is periodic in nature. The nonanalytic function of the frictional term in terms of tidal flow was developed into power series, and later to the form of Fourier series. By using the boundary conditions and introducing the assumed tidal flow through the itera-

tive process, the problem can be solved in general. Two tributaries join the main river in Taipei City, Taiwan. A mathematical model is applied to the whole system in which the controlled conditions are at boundaries and confluences. Model tidal flow at the river mouth is 1560 cms and at a bottleneck of the river, flow is around 1000 cms. The record flood at Kuan Tu is 24,800 cms. Therefore the tidal flow has little effect on the flood peak. (Knapp-USGS)
W71-01240

SOME PRACTICAL ASPECTS OF TIDAL COMPUTATIONS,

Delta Project, The Hague (Netherlands). Hydraulics Dept.

J. J. Dronkers.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 11-20, 1969. 10 p, 5 fig, 7 ref.

Descriptors: *Tides, *Tidal effects, *Estuaries, *Mathematical models, Model studies, Currents (Water), Sedimentation, Equations, Water level fluctuations.
Identifiers: Finite-difference equations.

In recent years, tidal computations on electronic computers have been used when planning engineering projects in tidal areas. Sometimes such computations are used together with hydraulic tidal models. Some practical aspects of the use of tidal computations for rivers and coastal areas are reviewed. One-dimensional or two-dimensional computations may be made for the transitional area of a river, that is the transition between a river and the sea, or an estuary. Both explicit and implicit finite difference systems are discussed. Some aspects of boundary conditions, forces that determine tidal movements in a coastal area, and effect of variations in density due to salinity intrusion on the tidal conditions of a river are discussed. (Knapp-USGS)
W71-01241

A COMPARATIVE STUDY OF REFLECTION IN A TIDAL CHANNEL AND IN ITS DISCRETIZED SIMULATED MODEL,

Calcutta Port Commissioners (India); and Jadavpur Univ., Calcutta (India).

K. K. Bandyopadhyay, and S. Das Gupta.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 1-9, 1969. 9 p, 3 fig, 2 tab, 7 ref.

Descriptors: *Tides, *Tidal effects, *Waves (Water), *Estuaries, Currents (Water), Navigation, Mathematical studies, Analog models, Water level fluctuations.
Identifiers: India.

Tidal propagation in estuaries was studied mathematically and by an analog model. In a long channel tapering upstream, siltation in the tidal apex can cause tidal-wave reflection. In many such channels, shallow reaches are numerous, and each shallow reach causes a reflection. Model studies were conducted with an exponentially tapered channel. In such a channel, both the hydraulic impedance and admittance varies continuously. Rigorous and exact mathematical solution is possible only when the exact variations of these parameters in the longitudinal direction are known. In this paper, such a tidal river is simulated by a discretized linear analog model. (Knapp-USGS)
W71-01242

WATER LEVEL FLUCTUATION DUE TO SAND BARRIERS BUILT UP BY EFFLUENT AND WAVE AT RIVER MOUTH, Osaka Univ. (Japan). Dept. of Civil Engineering. Toru Sawaragi.

French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 69-76, 1969. 8 p, 13 fig, 5 ref.

Descriptors: *Estuaries, *Sedimentation, *Water level fluctuations, *Sand bars, Hydraulic models, Mathematical models, Stage-discharge relations, Backwater.
Identifiers: River-mouth bars.

Tidal hydraulic computation in a tidal river was based on a cross-section of channel and on the outlet boundary condition. However, the cross-section at a river mouth may decrease due to a sand barrier built up by wave and tidal action. Estimation of water level elevation at the river mouth under the interaction of scour and waves (which gives the boundary condition) is a complicated problem. Water levels with no effluent, no waves, or co-existence of flow and wave are obtained for various cross-sections of the model river mouth. The change of cross-sectional area of a river due to scouring action of flow and closing action of wave is shown by an experiment using a movable bed and barrier. Water level fluctuations and sand barrier movement are estimated from the model results. (Knapp-USGS)
W71-01245

THE INFLUENCE OF FRICTION ON THE PROPAGATION OF TIDES (FRENCH),
Politecnico di Torino (Italy). Inst. of Hydraulics and Hydraulic Construction.
Giannantonio Pezzoli.

In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 95-101, 1969. 7 p, 7 ref.

Descriptors: *Waves (Water), *Tides, *Tidal effects, *Estuaries, Mathematical studies, Water level fluctuations, Fluid friction, Channel morphology, Fluid mechanics.
Identifiers: Tidal wave propagation.

Tidal wave propagation by level oscillations of sinusoidal law was studied in channels with gradually variable section and friction. Wave attenuation was described using the methods of non-linear mechanics. In the case of a horizontal bottom bed and constant section, a wave damps like the amplitude of a harmonic oscillator with square resistance. (Knapp-USGS)
W71-01248

A NUMERICAL MODEL OF A WIDE SHALLOW ESTUARY,
M. B. Abbott, and G. Marshall.

French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 61-67, 1969. 7 p, 7 fig, 3 ref.

Descriptors: *Tides, *Estuaries, *Currents (Water), *Mathematical models, Flow, Stream-flow, Tidal effects, Equations, Water level fluctuations, Discharge (Water), Open channel flow, Overland flow, Diffusion, Tidal marshes.
Identifiers: Netherlands.

A numerical model was made of an estuary in which flood and ebb flows are primarily in the direction of the estuary axis along deeper channels, but mainly transverse across drying flats. Flow parallel to the channel axis follows the dynamic equations of nearly-horizontal flow, while transverse flow follows a diffusion equation. The resulting equations are solved numerically using a two-level implicit scheme. This is unconditionally stable with a second-order truncation error that is entirely composed of phase error. The computation of diffusion coefficients necessitates an inverse mode capability that corresponds to the construction of a

data-reversible system. Test computations with diffusion coefficients set constant give satisfactory results. (Knapp-USGS)
W71-01250

SALINITY DIFFUSION AT THE INTERFACE OF STRATIFIED FLOW IN AN ESTUARY,
Hokkaido Univ., Sapporo (Japan). Dept. of Engineering Science.

Hisao Fukushima, Isao Yakuwa, and Susumu Takahashi.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 191-197, 1969. 7 p, 8 fig, 2 ref.

Descriptors: *Stratified flow, *Estuaries, *Saline water intrusion, Saline water-freshwater interfaces, Density stratification, Mixing, Dispersion, Diffusion, Turbulence, Vortices, Sampling, Sounding, Instrumentation.
Identifiers: Japan.

Salinity diffusion was studied at the mouth of the Ishikari River, Japan. The behavior of the salt wedge was observed by an ultrasonic method. The salinity distributions at the river mouth were obtained by chemical analysis and measurement of electrical conductivity. Longitudinal distributions of the surface salinity were calculated and found to agree with the observational results. When the salt wedge is advancing or static, the interface is clear. On the other hand, when the wedge is retrograding, the interface is diffusive. (Knapp-USGS)
W71-01251

A COMPUTER SIMULATION STUDY OF TRAVELTIMES OF INJECTED PARTICLES AND TIDE-WAVES IN WELL-MIXED ESTUARIES,

Geological Survey, Washington, D.C. Water Resources Div.
Chintu Lai.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 123-130, 1969. 8 p, 3 fig, 8 ref.

Descriptors: *Waves (Water), *Tides, *Stream-flow, *Computer models, *Estuaries, Currents (Water), Mathematical models, Model studies, Tidal effects, Water level fluctuations, Tracers, Tracking techniques, Water circulation.
Identifiers: Computer graphics.

A mathematical model using the method of characteristics and numerical procedures was constructed to simulate the unsteady motion of the water-surface profile and the movements of index particles in well-mixed estuaries. Techniques in computer graphics were applied to the model so that the numerical data of computer output representing the complex motions of water-surface movement, wave propagation, particle injection, and its travel along the channel can be graphically displayed. Two examples, one for a hypothetical tidal reach and the other for an actual tidal reach in the Connecticut River were used to illustrate computer animation and x-y plotting as graphical outputs. Examination of the results reveals that a large amount of qualitative and quantitative information concerning traveltimes of index particles and tide-waves can be obtained and clarified by this approach. (Knapp-USGS)
W71-01252

TIDES AND LONG PERIOD WAVES ON CONTINENTAL MARGINS,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Coastal Engineering.
Richard Silvester.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 113-121, 1969. 9 p, 4 fig, 5 ref.

Descriptors: *Waves (Water), *Tides, *Surges, *Surf, Ocean waves, Beach erosion, Mathematical studies, Shores, Beaches.
Identifiers: Wave attenuation, Shoaling.

Heights in the deep ocean of tidal or other long waves can be amplified some twenty times by shoaling, reflection and co-oscillation over the Continental Shelf and within embayments. The main criterion for this is the ratio of the Shelf width (or embayment dimensions) to the wave length involved. Graphs are presented from previous analyses for use in a step procedure to determine the shoreline heights from those pertaining in the open ocean. Attenuation effects are included by providing information on the friction factor and its influence on the length and height of these shallow water waves. (Knapp-USGS)
W71-01253

CROSS-SECTIONAL TIME SCALES AND DISPERSION IN ESTUARIES,
California Univ., Berkeley, Calif. Dept. of Civil Engineering.
Hugo B. Fischer.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 173-180, 1969. 8 p, 2 fig, 8 ref. NSF Grant GK-3210.

Descriptors: *Estuaries, *Saline water intrusion, *Saline water-freshwater interfaces, *Mixing, *Dispersion, Diffusion, Velocity, Turbulence, Tidal effects, Tides, Steady flow, Unsteady flow, Mathematical studies, Mathematical models.
Identifiers: Oscillating flow.

An oscillating flow is considered in an estuary of constant cross-section. Analytical study shows that longitudinal dispersion is caused by velocity variations in both the vertical and the transverse direction, and that the two effects are separate and additive. Lagrangian time scales can be defined separately for vertical and transverse velocity variations. Both Lagrangian scales can be related to their respective time scales for cross-sectional mixing by a factor which depends only on velocity distribution and cross-sectional shape, and varies only over a limited range. Thus the longitudinal dispersion coefficient can be estimated from knowledge of the cross-sectional mixing time scales. The longitudinal dispersion coefficient in an oscillating flow has a maximum value dependent on the mean square velocity deviation and the tidal period, but independent of the size of the cross-section. A net steady flow component causes dispersion at a rate independent of the presence of the oscillation; the dispersion coefficients caused by the steady and oscillating components are additive. (Knapp-USGS)
W71-01254

FLOW PATTERN OF DENSITY CURRENT AT A RIVER MOUTH,

Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.

For primary bibliographic entry see Field 02E.

W71-01255

NUMERICAL ANALYSIS ON THE SALINITY INTRUSION IN THE TIDAL ESTUARY OF WELL-MIXED TYPE,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.

K. Shinohara, T. Tsubaki, Y. Awaya, and K. Furumoto.

Field 02—WATER CYCLE

Group 2L—Estuaries

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 165-172, 1969. 8 p, 4 fig.

Descriptors: *Saline water intrusion, *Saline water-freshwater interfaces, *Mixing, *Estuaries, Dispersion, Diffusion, Salinity, Sea water, Surveys, Data collections, Sampling, Numerical analysis, Mathematical models.
Identifiers: Japan.

A one dimensional diffusion equation for salinity intrusion in well mixed estuaries was solved numerically, under proper boundary conditions. In this procedure, the numerical calculation is simplified by transforming the independent variable of the position of any cross section into the storage volume above the section. The value of longitudinal diffusion coefficient multiplied by the square of the cross sectional area is assumed to be a function of volume only. Example of numerical results are shown for the estuaries in some simple forms, in which the salinity concentration at the entrance of the estuary is kept equal to that of the sea water. The numerical result for a simplified channel form of a triangular pyramid shows fairly good agreement with the field data obtained at the Chikugo River, Japan. (Knapp-USGS)
W71-01256

ON THE STATISTICAL PROPERTIES OF INTERNAL WAVES FORMED AT THE INTERFACE OF ARRESTED SALINE WEDGES,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.

T. Tsubaki, M. Hamamura, and M. Hasimoto.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 157-164, 1969. 8 p, 7 fig, 1 tab, 7 ref.

Descriptors: *Waves (Water), *Saline water intrusion, *Saline water-freshwater interfaces, *Estuaries, Tides, Tidal effects, Frequency analysis, Fourier analysis, Statistical methods, Statistics, Statistical models.
Identifiers: Internal waves, Interfacial waves, Spectral analysis.

A series of laboratory experiments were carried out on the statistical properties of the internal wave formed at the interface of an arrested saline wedge. The internal wave is the overlapping of waves of short period wave on those of long period, and is composed of wide range of frequency components. The frequency spectrum of internal wave follows a -5/3 power law near the first energy peak corresponding to long waves and has an equilibrium range that follows a -3 power law in the high frequency range. Saline spectra in the neighbourhood of an interface were evaluated and the mechanism of mixing phenomena was studied in connection with the internal wave spectrum. Wave height and wave velocity of the internal wave were evaluated experimentally. (Knapp-USGS)
W71-01257

AMPLITUDE OF TEMPERATURE AND SALINITY VARIATIONS IN THE WATER OF THE SEBOU ESTUARY (MOROCCO), (FRENCH),
M. Combe.

In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 141-156, 1969. 16 p, 7 fig, 1 tab, 13 ref.

Descriptors: *Estuaries, *Tidal effects, *Saline water intrusion, *Discharge (Water), Streamflow, Water level fluctuations, Salinity, Water chemistry, Profiles, Sampling.
Identifiers: Morocco.

The Sebou river has the greatest discharge of Moroccan rivers; it empties into the ocean through an estuary where the influence of the sea is very strong. When the river is at its lowest, the dynamic effects of tide are felt up to 85 Km from its mouth. Series of measurements were taken in 1966 when river water level fell exceptionally low. Such measurements enabled determination of the maximum limits of salt water intrusion (35 Km from the river mouth) as well as the thermic variations of water (40Km). A graph synthesizes the salinities reached in the longitudinal section of the estuary. (Knapp-USGS)
W71-01258

TRANSFORMATION AND RUN-UP OF TSUNAMI TYPE WAVE TRAINS ON A SLOPING BEACH,

Tetra Tech, Inc., Pasadena, Calif.
For primary bibliographic entry see Field 08B.
W71-01259

ON DIFFUSION OF SALINITY IN SEA AREA WITH TRIBUTARY RIVERS—CASE OF ARIAKE BAY NEAR THE RIVER CHIKUGO,
Ministry of Agriculture and Forestry, Yawata (Japan). Agricultural Engineering Research Station, and Japan Engineering Consultants Co., Ltd., Tokyo.

Juichi Kato, Seiya Hagino, and Isao Akizuki.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 199-206, 1969. 8 p, 5 fig, 6 ref.

Descriptors: *Estuaries, *Saline water systems, *Sedimentation, *Computer models, *Computer programs, Mathematical models, Model studies, Water resources development, Urbanization, River basin development.
Identifiers: Japan, Ariake Bay.

Information on the distribution of tidal currents and salinity density in the vicinity of estuaries is both extremely important and indispensable for the establishment of rational and comprehensive development plans for various industries. To obtain a solution in the bounds in which Navier-Stokes equation and the diffusion equation may be applied, electronic computer programs were developed. Ariake Bay, Japan which was selected as an example, has complicated boundaries and drifting sand in its currents. (Knapp-USGS)
W71-01260

TURBULENT DISPERSION IN PERIODIC FLOW,

Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
Awaya Yoichi.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 207-214, 1969. 8 p, 4 fig, 6 ref.

Descriptors: *Dispersion, *Turbulent flow, *Mixing, *Estuaries, Unsteady flow, Tides, Tidal effects, Stratified flow, Water level fluctuations.
Identifiers: Oscillating flow, Longitudinal dispersion.

The longitudinal dispersion of matter in a mixed estuary is usually regarded as the same as that for a steady flow. In some estuaries, however, where the length travelled by water particles during a half tide is not sufficiently large compared with a linear dimension of a cross section, the mean value of dispersion coefficient during a tidal cycle is considerably decreased. The dispersion of matter in periodically alternating currents through a pipe is considered theoretically and experimentally, and an approximate formula of dispersion coefficient in alternating current is proposed. (Knapp-USGS)
W71-01261

A GRAPHICAL SUMMARY OF DISSOLVED-OXYGEN DATA FOR THE DELAWARE RIVER ESTUARY FOR WATER YEARS 1965-69,
Geological Survey, Harrisburg, Pa.
For primary bibliographic entry see Field 05A.
W71-01327

A LOOK AT THE HUDSON RIVER ESTUARY,
Geological Survey, Garden Grove, Calif.
Mark W. Busby, and Kenneth I. Darmer.
Water Resources Bulletin, Vol 6, No 5, p 802-812, September - October 1970. 11 p, 6 fig, 3 ref.

Descriptors: *Estuaries, *Hudson River, *Tides, *Waves (Water), Tidal effects, Discharge (Water), Water level fluctuations, Data collections, Stream gages, Gaging stations, Flowmeters, Current meters, Hydrologic data, Stage-discharge relations, New York.
Identifiers: Hudson River Estuary (NY).

Background information is provided on the effect of tidal waves upon the movement of water in the Hudson River estuary. Three continuous stage recorders were operated and current-meter discharge measurements were made throughout a tidal cycle. Peak discharge rates in the estuary at Poughkeepsie may be as great as 500,000 cubic feet per second and total daily tidal volumes as great as 20 billion cubic feet move in the estuary. (Knapp-USGS)
W71-01331

RESOURCE MANAGEMENT IN THE COASTAL ZONE: THE POLICY PROBLEM,
Clemson Univ., S.C. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 06B.
W71-01352

HYDROGRAPHY OF THE PAMLICO RIVER ESTUARY, N.C.,
North Carolina Water Resources Research Inst., Raleigh.
John E. Hobbie.

Available from tNTIS as PB 195-780, \$3.00 in paper copy, \$0.95 in microfiche. North Carolina Water Resources Research Institute, Report No. 39, August 1970. 69 p, 6 tab, 37 fig, 17 ref. OWRR Project B-004-NC (5).

Descriptors: Hydrography, *Oceanography, Estuaries, *Salinity, *Dissolved oxygen, *Temperature, *Tidal effects, Wind tides, North Carolina.
Identifiers: Pamlico Sound.

The Pamlico River Estuary extends some 35 miles from Washington, N. C. to Pamlico Sound. It is shallow, from 2 to 6 miles wide, naturally productive and has from 0.5 to 15 or 20 ppt salinity. The salinity regime is determined chiefly by the quantity of inflowing freshwater and changes in salinity of up to 10 ppt are common at any station. Lunar tides are small (less than 0.5 ft) but wind and wind tides can have important effects on the salinity distribution. In addition, the Coriolis Force causes much of the freshwater to flow along the south side of the estuary. The temperatures range from 3C (37F) to 34C (93F), although temperatures above 31C (89F) are unusual. On any given day, there could be horizontal temperature differences of up to 4 degrees (C) or 7 fahrenheit degrees. The estuary stratifies irregularly; when this happens in the summer complete deoxygenation may occur. This condition may last for only a week and then be destroyed by wind. The benthic animals (bottom dwelling) are completely eliminated from large stretches of the river by the low concentrations of oxygen. (Howells-North Carolina)
W71-01359

COASTAL CHANGES,
Cambridge Univ. (England). Dept. of Geography.
For primary bibliographic entry see Field 06B.
W71-01366

RECENT DATA ON THE LEVEL OF PRIMARY PRODUCTION OF THE WORLD OCEANS (IN RUSSIAN),

Akademiya Nauk SSSR. Institut Okeanologii.
O. I. Koblenz-Mishke, V. V. Volkovskii, and Yu G. Kabanova.
Doklady Akademii nauk SSSR, Vol 183, No 5, p 1189-1192, 1968. 1 fig, 1 tab, 5 ref.

Descriptors: *Primary productivity, *Oceans, Pacific Ocean, Atlantic Ocean, Indian Ocean, Carbon.

Identifiers: Hydrosphere, Equatorial divergencies, Polar divergencies, Steeman estimates, Nielson estimates, Jensen estimates.

The international expeditions of the last 15 years permitted a revision of the world's ocean map of primary production. The largest part of recent information, reported in the article, was acquired by the use of different modifications of radiocarbon method. The average productivity of oceans in grams of carbon per square meter/year is: Pacific - 46.4, Atlantic - 69.4, Indian - 81.0, all seas - 97.8. In the less generalized subdivision, different parts of oceans are characterized by the following values of production in mg carbon per square meter/day: Oligotrophic waters of central subtropics - 70, transitional waters between subtropical and subpolar zones - 140, waters of equatorial divergence and oceanic regions of subpolar zones - 200, near-shore waters - 340, and neritic waters - 1000. The total production of the world's entire hydrosphere is estimated between 25 and 30 billion metric tons of carbon per year, with net production between 15 and 18 billion tons. (Wilde-Wisconsin)

W71-01482

SPECIFIC PECULIARITIES IN THE VERTICAL CIRCULATION OF WATER IN THE ARCTIC OCEAN (IN RUSSIAN),

Akademiya Nauk SSSR. Institut Okeanologii.
V. N. Stepanov.
Doklady Akademii nauk SSSR, Vol 187, No 1, p 187-189, 1969. 2 fig, 6 ref.

Descriptors: *Ocean circulation, *Arctic Ocean, Surveys, Temperature, Salinity, Topography, Currents (Water), Turbulence, Benthos, Alaska.

Identifiers: *Vertical water circulation, North Pole, Spitsbergen.

This estimate of the vertical and horizontal translocation of water in the deep part of the Arctic Ocean was accomplished on a basis of survey along a transect laid out across the North Pole from Spitsbergen to Alaska. The vectors of vertical currents were established by a solution of two equations incorporating projections of the rate of vertical and meridional currents, coefficient of turbulent diffusion, and temperature and salinity of water. The deviations in the vertical circulation are attributed to the great topographical diversity of the bottom of the Arctic basin. (Wilde-Wisconsin)

W71-01483

DOMINANT FORMS OF PHYTOPLANKTON OF THE WHITE SEA (IN RUSSIAN),

V. D. Fedorov.
Doklady Akademii nauk SSSR, Vol 188, No 4, p 913-916, 1969. 2 fig, 2 tab, 2 ref.

Descriptors: *Marine microorganisms, *Phytoplankton, Shores, On-site data collections, Distribution patterns, Surveys.
Identifiers: *Karelian Shore, White Sea, Technometric survey.

The results are reported of a technometric survey of phytoplankton of the White Sea section near the Karelian shore during the growing season of 1968. Among the 52 species only 11 to 16 could be rated as 'dominant'. However, even their dominance was confined to certain segments of the vegetative period delineating the following four subdivisions: Spring-dominance of *Thalassiosira gravida*, *Fragilaria oceanica*, and *Nitzschia frigida*; biological summer-Skeletonema costatum; the end of

summer-Nitzschia delicatissima; fall-Dinophysis norvegica. (Wilde-Wisconsin)
W71-01484

STUDY OF THE ANNUAL CYCLE OF PLANKTONIC CHAETOGNATHS IN VILLEFRANCHE BAY BY THE METHOD OF PRINCIPAL COMPONENT ANALYSIS (IN FRENCH),

Station Zoologique, Villefranche-sur-Mer (France).
F. Ibanez, and S. Dallot.
Marine Biology, Vol 3, p 11-17, 1969. 7 fig, 3 tab, 18 ref.

Descriptors: *Worms, *Bays, *Analysis, Cycles, Nets, *Plankton.

Identifiers: *Planktonic chaetognaths, Villefranche Bay (France), Annual cycle, Principal component analysis, Sagitta, Juday-Bogorov net.

The annual cycle of chaetognaths was studied on samples collected from 0 to 75 meter depths with a Juday-Bogorov's net. The analysis singled out 2 communities of abundant species and 3 isolated species of worms among the 13 sorted categories. The first 3 components comprised 71.1% of the total variance. A partial correlation has indicated that the first component is trophic conditions, the second--vertical stability of water, and the third--the development of young stages. The acquired information yielded a 45% correlation between the physical and biological factors. (Wilde-Wisconsin)

W71-01495

DETERMINATION OF ASSIMILABILITY OF ALGAE, YEASTS, AND BACTERIA BY CERTAIN REPRESENTATIVES OF CLADOCERA (IN RUSSIAN),

For primary bibliographic entry see Field 02H.
W71-01496

A DISCOVERY OF A DEPOSIT OF PHOSPHORITIC CONCRETIONS IN THE INDIAN OCEAN (IN RUSSIAN),

Akademiya Nauk SSSR. Institut Geologii.
V. Kh Gevorkian, and Yu G. Chugonny.
Doklady Akademii nauk SSSR, Vol 187, No 4, p 906-908, 1969. 1 fig, 9 ref.

Descriptors: *Indian Ocean, Hydrogeology, Geologic formations, Rocks, Cenozoic era, Mesozoic era, Stratigraphy.
Identifiers: *Phosphorites, Meso-Cenozoic formations, Phosphorus pentoxide, Calcium oxide, Iron hydroxide, Sokotra Island, Aden Bay, Arabian Peninsula.

A deposit of phosphorites was discovered at a depth of 210 meters in the Aden Bay, near the Sokotra Island. The excavated sample of about 1.1 kg contained 326 loam-textured concretions of highly diversified form, surface appearance, and mantles of benthic organisms. The average contents of phosphorus pentoxide and calcium oxide are 28.6 and about 44%, respectively. The probable source of phosphorites are Meso-Cenozoic deposits forming the Sokotra and adjacent islands. (Wilde-Wisconsin)

W71-01497

DECREASE IN THE ROLE OF WARMWATER PLANKTONIC CONSTITUENTS IN THE POSYET BAY (SEA OF JAPAN) (IN RUSSIAN),

M. S. Kos.
Doklady Akademii nauk SSSR, Vol 184, No 4, p 951-954, 1969. 2 fig, 15 ref.

Descriptors: *Bays, *Aquatic life, *Ocean circulation, Fish, Zooplankton, Plankton, Crustaceans.

Identifiers: *Posyet Bay, *Sea of Japan, Pacific Ocean sardine, Japanese current, Paracalanus parvus, Calanoida, Cladocera.

Analyses of samples and fish harvest during the past 30 years have shown a partial decrease or dis-

appearance of several warmwater species of fish, including the valuable Pacific Ocean sardine, as well as many benthic crustaceans from the Posyet Bay, adjacent to the Zaliv of Petra Velikogo. The 1965 sampling has failed to reveal any Paracalanus parvus, one of the widely distributed and important member of Calanoida crustaceans. A decrease or disappearance was also recorded for the following tropical or subtropical members of the plankton: Labidocera pavo, Labidocera bipinnata, Labidocera japonica, Arcatia pacifica, Penilia aviostris, Acartia plumosa, Evadne tergestina, Evadne spinifera. These changes in the general hydrothermic and biotic conditions are presumably caused by the meandering of the Japanese Current. (Wilde-Wisconsin)

W71-01498

INTERNATIONAL HELGOLAND SYMPOSIUM ON THE CULTIVATION OF MARINE ORGANISMS AND ITS IMPORTANCE FOR MARINE BIOLOGY, 9-12 SEPTEMBER 1969,

Office of Naval Research, London (England).
James E. Hanks, and John D. Costlow, Jr.
Available from NTIS as AD-701 193, \$3.00 in paper copy, \$0.95 in microfiche. ONR (London) Conference Report, ONRL-C-3-70, January 22, 1970. 17 p.

Identifiers: *Marine biology, Symposia, West Germany, Aquatic animals, Fishes, Crustacea, Mollusca, Plankton, Microorganisms, Growth, Commerce, Seafood, *Aquaculture.

The program of the four-day symposium, 'Cultivation of Marine Organisms and Its Importance for Marine Biology', held at the Biological Institute, Helgoland, West Germany, Sept. 9-12, 1969, is reported. Some 250 scientists attended to hear 75 papers which covered both basic and applied aspects of cultivating fish, crustaceans, molluscs, lower invertebrates, plants and a variety of microorganisms. Two informal sessions, Fish Farming and Cultivation of Phytoplankton Populations, were also held to discuss the present state of knowledge and to define areas requiring further study both for scientific purposes and to allow commercial development of marine organisms.

W71-01504

DETAILED TEMPERATURE CROSS SECTION OF THE COLD-WATER BELT ALONG THE NORTHERN EDGE OF THE KUROSHIO,

Scripps Institution of Oceanography, La Jolla, Calif.

Yutaka Nagata.
Available from NTIS as AD-703 344, \$3.00 in paper copy, \$0.95 in microfiche. Journal of Marine Research, Vol 28, No 1, 1970, p 1-14. 7 fig, 6 ref.
Identifiers: Honshu (Japan), Ofunato Bay, *Cold water belts, *Bathythermograph data, Japan, *Sea water, Temperature, Seacoast, Temperature inversion, Depth finding, Surface temperatures, Hydrographic surveying, Bays.

On the basis of BT observations made at intervals of about one mile, a detailed temperature cross section of the cold-water belt along the northern edge of the Kuroshio is presented. Cold waters and sharp temperature inversions have been observed on the southern and northern margins of the cold-water belt. Within the cold-water belt, except in a narrow noninversion area, many temperature inversion layers have been observed, and the colder and warmer waters are arranged in a complicated pattern. These observations suggest that the very cold waters in the cold-water belt are fed through a cold-water core parallel to and off the Sanriku coast of Honshu, Japan.

W71-01507

ACOUSTIC TECHNIQUES OF FISH POPULATION ESTIMATION WITH SPECIAL REFERENCE TO ECHO INTEGRATION,

Washington Univ., Seattle. Fisheries Research Inst.
For primary bibliographic entry see Field 02H.
W71-01508

Field 02—WATER CYCLE

Group 2L—Estuaries

THE EFFECT OF CYCLONIC AND ANTICYCLONIC WATER MOVEMENTS ON THE DISTRIBUTION OF ORGANIC MATTER, Goddard Space Flight Center, Greenbelt, Md. K. H. Szekielda.

Available from NTIS as N70-22597, \$3.00 in paper copy, \$0.95 in microfiche. NASA TMX-63849, Feb 70. 17 p, 5 fig, 7 ref.

Descriptors: *Ocean currents, Hydraulic model, *Remote sensing infrared radiation, *Organic matter, *Aquatic life.

Identifiers: *Stoichiometrical model, Somali Coast, Infrared radiometer.

An anticyclonic water movement directed away from the upwelling region along the Somali Coast was detected with the high resolution infrared radiometer aboard the meteorological satellite Nimbus 2. The effect of this water movement on the distribution of organic matter is shown with a stoichiometrical model, based on elementary analyses of phytoplankton. The predicted position of the maximum of the organic material was verified with chlorophyll measurements near the Somali Coast.

W71-01513

PHOTOSYNTHETIC ACTION SPECTRA OF MARINE PHYTOPLANKTON 1966-1969, Scripps Institution of Oceanography, La Jolla, Calif.

Francis T. Haxo.

Available from NTIS as AD-704 176, \$3.00 in paper copy, \$0.95 in microfiche. Final rept, Nov 1, 1966-Sept 30, 1969. April 6, 1970. 11 p. Rept No SIO-Ref-70-12. ONR Contract N00014-67-A-0109-0005.

Identifiers: *Plankton, *Photosynthesis, Marine biology, Algae, Light, Chlorophylls, *Phytoplankton.

Much of our knowledge concerning the wavelength dependence of photosynthesis in marine phytoplankton has been derived indirectly from laboratory studies of photosynthetic oxygen evolution in cultured micro-algae or on thin bladed macroscopic algae. Studies on unicellular algae have been limited to a rather few species, mostly freshwater, and naturally occurring populations have not been examined. The present investigation was undertaken to provide such information for a wider variety of marine micro-algae representing diverse pigment systems and to examine wavelength and light intensity dependence of photosynthesis in natural occurring oceanic populations. Results obtained to date are briefly summarized in this report.

W71-01526

SEDIMENTS, OCEANOGRAPHIC OBSERVATIONS, AND FLORISTIC DATA FROM TAMPA BAY, FLORIDA, AND ADJACENT WATERS, 1961-65,

Bureau of Commercial Fisheries, St. Petersburg Beach, Fla. Biological Lab.

John L. Taylor, and Carl H. Saloman.

Available from NTIS as PB-189 117, \$3.00 in paper copy, \$0.95 in microfiche. Contribution No 51, December 1969. 561 p, 39 ref.

Identifiers: *Oceanographic data, Florida, *Ocean bottom sampling, Sedimentation, Algae, Temperature, Salinity, Calcium compounds, Carbonates, Invertebrates, Carbon compounds, Organic compounds, Silicates, Particle size, Statistical data, Bays, Tampa Bay, Cores.

Sediment type at each of 773 stations is characterized, and isopleths of mean grain size, sorting, calcium carbonate, and organic carbon are given. Oceanographic data include water temperature, salinity, pH, and water depth. The occurrence of sea grasses and filamentous algae is noted. Methods of sampling and analyses are described.

W71-01537

CHANGES IN ELECTROLYTIC CONDUCTANCE OF SEAWATER DURING PHOTOSYNTHESIS AND RESPIRATION, Woods Hole Oceanographic Institution, Mass. P. Kilho Park, Alvin L. Bradshaw, David W. Menzel, Karl E. Schleicher, and Herbert C. Curl, Jr.

Available from NTIS as AD-702 217, \$3.00 in paper copy, \$0.95 in microfiche. Journal of the Oceanographic Society of Japan, Vol 25, No 3, p 119-122, June 1969. 1 fig, 12 ref. ONR Contract Nonr-1286 (00), 2196 (00).

Identifiers: *Sea water, Electrical conductance, *Plants (Botany), Sea water, Electrolytes, Salinity, Photosynthesis, Respiration, Ions, Carbonates, Photosynthetic assimilation.

Common rock weed, *Fucus vesiculosus*, decreased the seawater conductance by 0.04 percent during a photosynthetic assimilation of 0.4 mM of inorganic carbon dioxide, but it only increased the conductance by 0.02 percent during the respiration. Transformation of bicarbonate to carbonate ions during photosynthesis and vice versa during respiration are the main mechanism to change the conductance.

W71-01538

WASTE MANAGEMENT CONCEPTS FOR THE COASTAL ZONE, REQUIREMENTS FOR RESEARCH AND INVESTIGATION.

National Academy of Sciences-National Research Council, Washington, D.C. Committee on Oceanography.

For primary bibliographic entry see Field 05G.

W71-01544

03. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

DEVELOPMENT OF AN IMPROVED TUBULAR REVERSE OSMOSIS MODULE FOR WATER TREATMENT,

Philco-Ford Corp., Newport Beach, Calif.

John L. Richardson, Gilbert Segovia, and Alexander O. Brodie.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price \$1.25 per copy. Office of Saline Water Research and Development Progress Report No 576, December 1970. 113 p, 15 tab, 58 fig, 10 ref. OSW Contract 14-01-0001-2206.

Descriptors: *Reverse osmosis, *Membranes, Membrane processes, Desalination, Permeable membranes, Semi-permeable membranes, Osmosis.

Identifiers: Reverse osmosis module.

Tubular membrane casting and heat treating techniques have now been improved to the point where reproducibility in product flux is within approximately one percent. By using sufficiently short evaporation times during the casting process, the salt-rejection properties of the membrane can be significantly increased. Viscosity data was obtained for the standard cellulose acetate casting solution over a wide range of shear rates. The data was fit with a modified hyperbolic model. A continuous tubular caster design was developed using the results of the fabrication variables study and the viscometric measurements. It is based on the principle of extrusion through an annular orifice onto moving split and butted tapes shaped into a cylindrical configuration. The continuous casting machine was built and operated. Tubular membranes up to approx. 20 feet in length were produced with this experimental device. Selected fiberglass yarns have been braided into sleeving and tested with tubular (approx. 1/4 in. in diameter) membranes. A small (approx. 1 gal/day) reverse osmosis demonstration unit was designed, built, and tested. (Kindley-Office of Saline Water)

W71-01199

SCALE CONTROL IN HIGH TEMPERATURE DISTILLATION OF SALINE WATER USING FLUIDIZED BED HEAT EXCHANGERS, Brookhaven National Lab., Upton, N.Y.

L. P. Hatch, and G. G. Weth.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Price \$0.65 per copy. Office of Saline Water Research and Development Progress Report No 571, July 1970. 61 p, 23 fig, 11 tab. OSW Contract 14-01-0001-1151.

Descriptors: *Scaling, *Sea water, *Fluidization, *Descaling, *Distillation, *Temperature, *Erosion control, Desalination, *Heat exchangers, Desalination apparatus.

Identifiers: High temperature, Fluidized bed, Scale filtration.

The report describes a method investigated during past three years for achieving scale free operation in the high temperature heating of saline waters by use of a fluidized bed of granular solids on the saline water side of a vertically oriented heat exchanger. Deposition of precipitated salts, largely calcium sulfate was mainly on the granular solids which present very large surface area to the solution. The mild scouring action of the hot moving bed prevented the formation or build-up of deposits on the heat exchanger or the particles. Bed materials used included balls of 1/8 in. alumina and bronze, 3/16 in. stainless steel, 0.08 in. lead shot, 0.05 in. copper shot, and 1/8 in. Cu-Ni cylinders. Scale prevention tests were conducted in single tube units and a 7-tube unit at temperatures from 340 degrees F to 400 degrees F, operated in the once-through and recirculation flow modes. It was found that scale could be removed by both a monel and porous carbon filter of 5 micron pore size. At 400 degrees F, the scale was a soft slurry easily purged but at 350 degrees F a more dense scale was found which built up on the filters. Erosion tests for up to 5000 hours at 300 degrees F were made on a number of bed materials. 3/32 in. carpenter 20 discs showed 2.2% weight loss in 1 year, stainless steel 316 - 3.5% loss, and 3/32 in 90-30 CuNi cylinders - 8.8% loss. Erosion was largely confined to rounding off of the corners. No reduction in tube wall thickness was found in any of the units. Results are reported for a 7-tube Lucite unit used to determine the basic requirements for maintaining uniform distribution of bed material among tubes. The fluidized bed offers a means for scale control to permit high temperature operations of sea water distillation plants. The economics of this scale control method was not determined. (Pruett-Office of Saline Water)

W71-01200

ASSEMBLY AND EVALUATION OF AN IMPROVED PPB OXYGEN ANALYZER FOR SEAWATER,

Dow Chemical Co., Freeport, Tex.

H. C. Behrens, E. F. Sablatura, J. D. Theologos, and B. P. Webb.

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 Price \$0.65 per copy. Office of Saline Water Research and Development Progress Report No. 572, (1970). 60 p, 4 tab, 16 fig, 27 ref, 4 append. OSW Contract 14-01-0001-1832.

Descriptors: *Dissolved Oxygen Analyzer, *Deaeration, *Corrosion, *Sea water, Desalination.

Identifiers: Monitoring Devices, Control Systems, Polarographic Analyses.

Studies currently under way on the behavior of metals in desalination environments indicate the extreme importance of dissolved oxygen in influencing the corrosion rate of common metals. OSW R. and D. Report No. 417, 'Seawater Corrosion Test Program', U. S. Department of the Interior, 1968. At the present state of the art, distillation-type desalination plants are designed to operate

under deaerated conditions. As the deaeration techniques are improved, resulting in lower and lower levels of dissolved oxygen, the ability to monitor those levels is taxed. In high purity boiler feed water, a number of commercial instruments have demonstrated accurate measurement of dissolved oxygen in the low parts-per-billion (ppb) range. Other commercial instruments have successfully measured dissolved oxygen at parts-per-million (ppm) levels in various fresh and saline streams. None of these have been successful at levels of 0 to 10 ppb oxygen in seawater under desalination plant environments. This report covers the development and proving of an on-stream oxygen analyzer system capable of accurate dissolved oxygen measurements in the range of 0 to 10 ppb in seawater. (Filban-Office of Saline Water) W71-01201

STUDY OF WATER PLANT ISOLATION FROM CONTAMINATION,
National Nuclear Corp., Palo Alto, Calif.
Fredrick Crever.
For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price \$1.50 per copy. Office of Saline Water Research and Development Progress Report 526, October 1969. 147 p, 37 tab, 17 fig. OSW Contract No. 14-01-0001-2192.

Descriptors: *Desalination, *Distillation, *Nuclear power plants, *Flash distillation.
Identifiers: Water plant isolation, Water-Power plant combination, *Nuclear contamination.

The scope of this effort included a determination of the potential of radioactive contamination of product water from a MSF desalination plant when water plant is connected to a nuclear power plant. Data from existing nuclear power plants was reviewed and analyzed. The report also includes recommendations on isolation of the water plant brine heater where steam is taken directly from the nuclear power plant and where an intermediate heating system is used to provide steam to the brine heater. (Robinson-Office of Saline Water) W71-01202

BIOLOGICAL EFFECTS OF EFFLUENT FROM A DESALINATION PLANT AT KEY WEST, FLORIDA,
Westinghouse Ocean Research Lab., San Diego, Calif.
For primary bibliographic entry see Field 05C.
W71-01266

3B. Water Yield Improvement

EFFECTS OF SIMULATED CLOUD SEEDING ON STREAMFLOW OF SELECTED WATERSHEDS IN PENNSYLVANIA,
Pennsylvania State Univ., University Park. School of Forest Resources.
William E. Sopper, and L. A. V. Hiemstra.
Water Resources Bulletin, Vol 6, No 5, p 754-766, September - October 1970. 13 p, 8 fig, 8 tab, 4 ref. Bureau of Reclamation Contract 14-06-D6571.

Descriptors: *Cloud seeding, *Rainfall - runoff relationships, *Low-flow augmentation, *Simulation analysis, *Pennsylvania, Mathematical models, Simulated rainfall, Water supply, Streamflow, Hydrograph analysis, Weather modification, Droughts.
Identifiers: Simulated cloud seeding.

A mathematical model was developed to simulate the hydrologic behavior of five small watersheds in central Pennsylvania. Continuous hydrographs for the 6-month period, April to September 1964, were simulated. Synthesized rainfall cycles consisting of increasing rainfall by 10, 20, and 30% to simulate the effects of cloud seeding were processed through the watershed model to determine the effects on low flow augmentation. Other rainfall cy-

cles used consisted of increasing every third storm by 30% and of developing a rainfall cycle by processing daily radiosonde data through a mathematical cumulus cloud model to obtain a prediction of rainfall following seeding. A comparison of actual and predicted hydrographs indicated that simulated cloud seeding resulted in significant monthly and seasonal water yields. In general, the results of the study appear to indicate that on a theoretical basis cloud seeding would be a feasible method of augmenting low streamflow during the summer months on watersheds in the northern Appalachian region. (Knapp-USGS) W71-01116

CLOUD SEEDING EXPERIMENT - TASMANIA, 1965 - 1966 ANNUAL REPORT,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Radiophysics Lab.
E. E. Adderley, and E. J. Smith.
Available from NTIS as N70-17006, \$3.00 in paper copy, \$0.95 in microfiche. January, 1969. 200 p. RPR-168.
Identifiers: *Australia, *Cloud seeding, *Rain, *Silver iodides, Airborne equipment, Cumulus clouds, Rain gages.

Experiments are being conducted to determine the amount by which seeding clouds with silver iodide smoke released from an aircraft can increase precipitation in a hydroelectric catchment area. The seeding takes place during alternate years according to a randomized time pattern. Clouds are considered suitable for seeding if their tops consist of supercooled water drops at -10 deg C or colder for cumulus clouds, and -5 deg C for stratiform clouds; if they are dense, durable, and compact; and if they have a lifetime exceeding 30 minutes. Rainfall measurement methods are described. Figures depict cloud and wind conditions, target and control rainfall, seasonal variations, and variations with time. Rainfall totals are tabulated for seeded and unseeded periods.
W71-01129

EVAPORATION FROM SNOW AND EVAPORATION RETARDATION BY MONOMOLECULAR FILMS. A REVIEW OF LITERATURE,
Cold Regions Research and Engineering Lab., Hanover, N.H.
Charles W. Slaughter.
Available from NTIS as AD-708 860, \$3.00 in paper copy, \$0.95 in microfiche. CRREL Special Report 130, June 1970. 30 p.
Identifiers: *Snow, Evaporation, *Evaporation, Control, *Monomolecular films, Snow, Protection, Melting, Water vapor, Temperature, Wind, Velocity, Moisture, Reviews, Humidity, Barometric pressure, *Snow evaporation, *Evaporation retardation.

Evaporation from snow is discussed. Methods of determining snow evaporation are explained; a summary of available data on snow evaporation is presented. The general field of evaporation retardation is also discussed, along with the limited information currently available on retardation of evaporation from snow.
W71-01143

SOME PROBLEMS CONCERNING THE TECHNIQUE OF SEEDING SUPERCOOLED STRATUS CLOUDS FOR THE PURPOSE OF SCATTERING THEM,
Foreign Technology Div., Wright-Patterson AFB, Ohio.
S. K. Kudryavtseva, and I. P. Polovin.
Translated from Russian. Available from NTIS as AD-705 146, \$3.00 in paper copy, \$0.95 in microfiche. 23 March 70, 25 p, Rept no FTD-MT-24-50-70. March 1970. 20 p. FTD-MT-24-50-70.
Identifiers: *Stratus clouds, Artificial precipitation, Scattering, Rainfall, Fog, Atmospheric sounding, Nucleation, Ice, Crystallization, Wind, USSR, Translations, *Cloud seeding, Fog dispersal.

A report on cloud seeding and dispersion of stratus clouds is presented. To update methods of inducing rain and dispersing clouds and fog, it is necessary to determine optimum intervals between the seeding lines. An experimental study was carried out by the Ukrainian Hydrometeorological Research Institute for this purpose in the following manner: after sounding the cloud layer and establishing its parameters, initial seeding was made to find the maximum width of crystallization zone. Then the seeding was repeated along five or six lines normal to the wind direction at the cloud top level. Experiments showed that for complete dispersal of clouds the stage of cloud development is an important factor in determining the interval between the seeding lines. The experiments also indicated that larger dosages of seeding substances produce complete dispersion of clouds in the growing phase.
W71-01164

WATERSHED MANAGEMENT AND SOIL EROSION PROBLEMS IN WEST PAKISTAN,
For primary bibliographic entry see Field 02J.
W71-01400

HYGROSCOPIC ADDITIVES TO PHENOXY HERBICIDES FOR CONTROL OF SALT-CEDAR,
Agricultural Research Service, Los Lunas, N. Mex. Crops Research Div.
Eugene E. Hughes.
Weed Science, Vol 16, No 4, October 1968, p 486-488. 6 tab, 5 ref.

Descriptors: *Herbicides, *Brush control, *Tamarisk, *Evaporation control, *Phreatophytes, Plant growth regulators, 2, 4-D, 2, 4, 5-T, Southwest U. S., Arid lands, Air temperature, Humidity, Spraying, Chemcontrol, Greenhouses, Foliar application.
Identifiers: *Hygroscopic additives, *Phenoxy herbicides, *Herbicide evaporation, *Polypropylenediol, Phreatophyte invasion, Silvex, Foliage injury.

Water supplies in southwestern United States have been greatly influenced by the invasion of phreatophytes into river basins. These experiments were conducted to determine the possibility of preventing rapid herbicidal evaporation due to high temperature and low humidity. Greenhouse studies on saltcedar (*Tamarix pentandra* Pall) control showed that when one of the hygroscopic compounds (polypropylenediol) was added to water solutions of phenoxy herbicides, it significantly increased injury from most treatments. Foliage injury from herbicides tested, except the oil-soluble amine formulations of 2,4-dichloro-phenoxyacetic acid (2, 4-D), 2- (2, 4, 5-trichlorophenoxy), PROPRIONIC ACID (silvex), and 2, 4-D plus 2, 4, 5-trichlorophenoxy acetic acid (2, 4, 5-T) (1:1), increased when polypropylenediol was added to the spray solution at 5 percent by volume. The increased activity was affected by the rate of the additive, temperature, humidity, and herbicidal formulation. Tables show influence of hygroscopic compound, polypropylenediol, artificial rain, humidity and temperature. (Popkin-Arizona) W71-01405

SELECTIVE CONTROL OF PLAINS PRICKLYPEAR IN RANGELAND WITH HERBICIDES,
Nebraska Univ., Lincoln. Dept. of Agronomy.
G. A. Wicks, C. R. Fenster, and O. C. Burnside.
Nebraska Agricultural Experiment Station, Journal Series, Paper No 2496. Weed Science, Vol 17, No 4, October 1969, p 408-411. 5 tab, 12 ref.

Descriptors: *Plant growth regulators, *Great plains, *Ranges, *Herbicides, *Brush control, Spraying, 2,4-5-T, Nebraska, Arid lands, Semiarid climates, Chemcontrol, Wetting, Treatments.
Identifiers: *Pricklypear, *Herbicide efficiency, *Silvex, *Dicamba, *Plant injury, Picloram, Semiarid lands, Rotary hoeing.

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3B—Water Yield Improvement

Pricklypear inhabits rangeland throughout the Great Plains and other arid to semiarid lands. Experiments were conducted at Crawford and Kimball, Nebraska, during 1962 to 1965 to determine the effect of 13 herbicides on plains pricklypear (*Opuntia polyacantha* Haw.). The best control was obtained with 2- (2,4,5-trichlorophenoxy) propionic acid (silvex), 4-amino-3,5,6-trichloropicolinic acid (picloram), 3,6-dichloro-o-anisic acid (dicamba), and (2,4,5-trichlorophenoxy) acetic acid (2,4,5-T). Silvex and picloram were superior to dicamba and 2,4,5-T in controlling plains pricklypear, but picloram and dicamba injured native grasses. Rotary hoeing plains pricklypear claddodes just prior to spraying improved herbicide performance. Simulated raiiling was not a consistent control measure. Evaluation of plains pricklypear control was made 1 and 2 years after herbicide application. Tables of plains pricklypear control in west Nebraska rangeland, and effect of rotary hoeing and herbicide spraying are included. (Popkin-Arizona)
W71-01408

ATMOSPHERIC MODELING, FIELD PROGRAMS, AND DECISION SYSTEMS,
Rand Corp., Santa Monica, Calif.
For primary bibliographic entry see Field 02B.
W71-01535

3C. Use of Water of Impaired Quality

SALT-FERTILIZER-SPECIFIC ION INTERACTIONS IN SOIL,
New Mexico State Univ., University Park. Dept. of Agronomy.
H. E. Dregne, and Hessam Mojallali.
New Mexico Agricultural Experiment Station Bulletin 541, January 1969. 16 p, 10 tab, 4 fig, 13 ref.

Descriptors: *Soil-water-plant relationships, *Ion exchange, *Crop production, *Salt tolerance, *Salinity, Fertilizers, Saline water systems, Saline soils, Cation exchange, Electrical conductance, Barley, Sodium chloride, Potassium compounds, Nitrogen, Phosphorous, New Mexico, Arid lands, Irrigation effects, Salts, Hydrogen ion concentration, Seeds, Sulfates, Soil chemical properties, Greenhouses, Data collections.
Identifiers: *Ion antagonism, *Salt-fertilizer interaction, *Salinity damage, *Crop cation content, *Exchangeable cation content, Specific ion interaction, Cations, Anions.

Excessive soil salinity is a continuing problem in irrigated areas throughout the world. The purpose of these reported experiments is to determine the effectiveness of ion antagonism and salt fertilizer interactions in reducing salinity damage to barley. Greenhouse experiments in a calcareous Berino sandy loam with factorial treatments of sodium chloride, potassium chloride, nitrogen, and phosphorous were conducted on barley. Applications of N-, P-, K- fertilizers reduced the adverse effect of low-to-moderate levels of soil salinity on yields. Yields were depressed more by KCl than by NaCl. Barley cation content varied directly with soil salinity. NaCl was more detrimental than sulfate to crop yields. Tables present data on pretreatment soil properties, treatments to determine salt-fertilizer and specific ion effects, treatment ion ratios, crop yields, barley cation and anion content, soil water soluble and exchangeable cation content, crop yields and electrical conductivity of soil saturation extract. Figures of electrical conductivity of soil saturation extract versus crop yield and pH, and percent salt versus exchangeable cations in soil are included. (Popkin-Arizona)
W71-01283

PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,
New Mexico State Univ., University Park. Dept. of Agronomy.

H. E. Dregne.
New Mexico Agricultural Experiment Station, New Mexico State University, Bulletin 543, March 1969. 16 p, 7 tab, 16 fig, 3 ref. OWRR Project A-005-NMEX.

Descriptors: *Forecasting, *Crop production, *Salinity, *Irrigation water, *Water requirements, Evaluation, Irrigation efficiency, Consumptive use, Crop response, Soil-water-plant relationships, Salt tolerance, Water quality, Soil chemical properties, Leaching, Alfalfa, Barley, Cotton, Sorghum, New Mexico, Arid lands, Cron (Field), Economic feasibility, Saline water, Saline soils, Irrigation effects, Depth, Root zone.
Identifiers: *Maximum crop production, *Salinity-water effects, *Adverse water, Leaching requirement, Pecos Valley (New Mexico).

Reduced Pecos Valley (eastern New Mexico) water supplies require economic maximization. Crops vary in water requirement and salt tolerance. Salinity is the principal factor that reduces crop yield. This study uses data on salt tolerance and water requirement of alfalfa, barley, corn, cotton and sorghum to estimate the effect on crop yields. Those estimates provide the basis for economic evaluation of crop, amount and salinity of water. Assumptions were: (1) soils permit leaching; (2) initial soil salinity does not determine equilibrium salinity; (3) soil depth does not determine average soil salinity; (4) 10 percent of the applied water drains out of the root zone; (5) electrical conductivity of the drainage water is twice that of soil saturation; (6) adverse water and salinity affects are additive; (7) salinity-water yield reduction is independent of inherent soil productivity; (8) irrigation is surficial; and (9) precipitation reduces salinity. Average soil salinity, salt tolerance, water requirement, salinity-water effects on yield, and maintenance of maximum yields are enumerated. Tables show salinity with irrigation amounts, and salinity-water effect on 5 crops. Curves present salinity-water application, effect and maximization on 5 crops. (Popkin-Arizona)
W71-01299

3D. Conservation in Domestic and Municipal Use

GEOLOGY FOR PLANNING AT CRESCENT CITY, ILLINOIS.
Illinois State Geological Survey, Urbana.

Robert E. Bergstrom, Compiler. Illinois Geological Survey Environmental Geology Notes, No 36, September 1970. 15 p, 5 fig, 7 ref.

Descriptors: *Geology, *Groundwater, *Planning, *Construction, Foundations, Water supply, Aquifers, Bedrock, Artesian wells, Water quality, Solid wastes, Septic tanks, Geologic mapping, Flood plains, Particle size.
Identifiers: Gas-storage reservoir, Lake sediments, Tables.

On the morning of June 21, 1970, the village of Crescent City, Illinois, about 75 miles south of Chicago, was heavily damaged by explosions and fires from 11 railroad tank cars containing propane in a train that derailed within the village limits. This report is the result of a request, following the catastrophe, from the Illinois State Department of Local Government Affairs to assess the municipal conditions at Crescent City and prepare a plan for rebuilding the village. The results of the study show that lake sediments in the northern and western halves of the region are generally fine-grained and tight, so that they do not yield water rapidly to excavations, even though the water table is relatively shallow. For the same reason, they do not accept fluids rapidly and are not well suited for the operation of septic tank fields. They should provide reasonably sound foundation materials and, along with the underlying tills, should afford protection to underlying aquifers where solid waste disposal is planned. Groundwater for present demands in the area has been generally available from sand and

gravel aquifers at the base of the glacial drift. The bedrock except for the uppermost formations is generally not favorable for development of groundwater supplies because much of the deeper water is too highly mineralized for most purposes. An important geological feature of the area is the gas-storage structure between Crescent City and Watseka. (Woodard-USGS)
W71-01111

3E. Conservation in Industry

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM.
Garver and Garver, Little Rock, Ark.
For primary bibliographic entry see Field 06B.
W71-01166

FLORIDA EX REL MYERS V CONE (LEASING SALT WATER BEDS).
For primary bibliographic entry see Field 06E.
W71-01447

3F. Conservation in Agriculture

A RECONNAISSANCE OF THE WATER RESOURCES IN THE PORTNEUF RIVER BASIN, IDAHO,
Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 02E.
W71-01104

THE HYDRAULIC FILTER LEVEL OFFSET METHOD FOR THE FEEDBACK CONTROL OF CANAL CHECKS; COMPUTER PROGRAM FOR SYSTEM SIMULATION,
California Univ., Berkeley. Hydraulic Engineering Lab.
For primary bibliographic entry see Field 08B.
W71-01130

THE NATURE AND DISTRIBUTION OF FARMING IN NEW YORK STATE,
New York State Office of Planning Coordination, Albany.
Howard E. Conklin, and Robert E. Lintron.
Available from NTIS as PB-190 477, \$3.00 in paper copy, \$0.95 in microfiche. December 1969. 36 p.
Identifiers: *Agriculture, Distribution, *Economics, New York, Labor, Actual photographs, Volume, Production, Terrain, Soils, Climatology, Water supplies, Commerce, Transportation, Budgets, Agricultural economics.

The report analyzes commercial farming in New York State and poses questions to be considered in relating farming to planning and development plans on local, regional and state levels. The economic viability of farm areas—each farm having been appraised and classified through air photos or staff inspection—is illustrated by a 45 x 38 inch map. While commercial farming occupies one-third of the state's land now, only 15 percent is identified as having high viability and another 15 percent moderate viability, taking into consideration such factors as soil, topography, climate, water resources, location, markets, transportation, farm investment, farming skills, technology, competition, urban influences and government policies. The study shows the number of farms has been decreasing but farm size and total output have increased, and the trend will likely continue.
W71-01133

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME II.
Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06E.

W71-01185

THE INFLUENCE OF INADEQUATE WATER SUPPLY ON METABOLISM IN BIOLOGICAL SYSTEMS WITH EMPHASIS ON PROTEIN SYNTHESIS AND NUCLEIC ACID METABOLISM,

Florida Univ., Gainesville. Water Resources Research Center.

For primary bibliographic entry see Field 021.

W71-01191

RELATIONSHIPS BETWEEN PESTICIDAL APPLICATION AND WATER CONTAMINATION UNDER IRRIGATION IN THE GREAT PLAINS,

Kansas Water Resources Research Inst., Manhattan.

For primary bibliographic entry see Field 05B.

W71-01195

EXPERIENCE WITH THE MATHEMATICAL MODEL OF THE HYDRAULIC NETWORK OF RIJNLAND WATER BOARD,

Waterloopkundig Laboratorium, Delft (Netherlands).

For primary bibliographic entry see Field 06A.

W71-01227

SOIL WATER AND TREE GROWTH IN A GREAT PLAINS WINDBREAK,

Forest Service (USDA), Lincoln, Neb., Rocky Mountain Forest and Range Experiment Station.

For primary bibliographic entry see Field 021.

W71-01280

FERTILIZATION OF THE GREGG VARIETY OF COTTON UNDER IRRIGATION AT THE NORTHEASTERN BRANCH STATION,

New Mexico State Univ., University Park; and New Mexico Agricultural Experiment Station, University Park.

David Williams, and V. H. Gledhill.

Research Report 151, June 1969. 8 p., 8 tab.

Descriptors: *Fertilization, *Cotton, *Crop production, *Plant growth, Nitrogen, Phosphorous, Potassium, Irrigable land, New Mexico, Arid lands, On-site tests, Data collections, Fibers (Plant), Analysis.

Identifiers: *Gregg variety (Cotton), *Irrigated crop, Tucumcari (New Mexico).

This study was conducted to determine whether irrigated cotton yields in Tucumcari, New Mexico, area could be consistently increased by the proper use of nitrogen, phosphorous and potassium fertilizers. Tests were run on the Gregg cotton variety in 1964, 1965 and 1966. A skip-row method of planting with two rows of cotton and two unplanted rows was used. A factorial experiment and a no-fertilizer check was used. Nitrogen (ammonium nitrate) at 30, 60, 90 or 120 pounds N per acre, phosphorous (treble superphosphate) at 0, 20 and 40 pounds P per acre and potassium (Muriate of potash) at 0 and 29 pounds K per acre were applied. Eight fiber characteristics were determined. A statistical analysis of the 3-year data was made. The test data suggest that variable response to fertilizer will be obtained from cotton. Rate limits for nitrogen and phosphorous appear to be 60 and 40 pounds per acre of N and P respectively. Potassium in the soil appears adequate for cotton under experimental conditions. Tables show cultural practices, climatic conditions, mean and yearly yields of Gregg variety by fertilizer and yearly fiber analysis. (Popkin-Arizona)

W71-01287

PLANTING DATES FOR IRRIGATED GRAIN AND FORAGE SORGHUMS AT THE NORTHEASTERN BRANCH STATION,

New Mexico Agricultural Experiment Station, University Park.

David H. Williams.

New Mexico Agricultural Experiment Station Bulletin 544, January 1969. 12 p., 10 tab.

Descriptors: *Planting management, *Sorghum, *Grains, *Forages, *Crop production, Irrigation, Plant growth, New Mexico, Arid lands, On-site tests, Data collections, Timing, Mature growth stage, Growth stages, Silage.

Identifiers: *Planting dates, *Irrigated crops, *Optimum yields, *Late-maturing hybrids, *Northeastern Branch Station (New Mexico), Tucumcari Irrigation Project (New Mexico).

This 1963-66 study was initiated to determine the influence of planting dates on irrigated grain and forage sorghums for producers on the Tucumcari Irrigation Project. Three hybrids representing early, medium and late maturity were used. Highest forage yields were obtained with a late-maturing hybrid, Lindsey 101F. Highest grain yields were obtained with the same late-maturing hybrid planted in mid May, Lindsey 101F. The 1965 trials were lost. If both high silage and high grain yields are desired, the data suggests a late-maturing hybrid should be planted by mid May. Early plantings of grain and forage sorghums avoided serious midge damage. Tables show cultural and climatic conditions of irrigated trials, yield and related data for different planting dates. (Popkin-Arizona)

W71-01293

GRAZING VS. WHEAT PRODUCTION ON MARGINAL UTAH CROPLAND,

Utah State Univ., Logan. Dept. of Range Science. John P. Workman, and Jack F. Hooper.

Utah Science, Vol 29, No 2, p 32-33, 60, June 1968. 2 tab, 2 photo.

Descriptors: *Range management, *Economic feasibility, *Cost analysis, *Grasslands, *Grazing, Wheat, Forages, Cattle, Dry farming, Drought resistance, Water loss, Utah, Arid lands, Return (Monetary), Livestock, Investment, Cover crops, Grasses.

Identifiers: *Livestock production, *Perennial grass, *Marginal cropland, *Synthetic budgets, *Economic loss, Permanent cover, Cash cost, Soil loss, Animal unit month (AUM), Losses (Monetary).

Many acres of Utah's marginal dry farm cropland were converted from wheat production to a permanent cover of drought tolerant perennial grasses under the Soil Bank Conservation Reserve Program of 1956. Many farmers in 1970 will be permitted to leave the released land in permanent cover for grazing or to return the land to wheat production. Data on potential livestock or wheat production, livestock and wheat production costs and break-even prices of livestock and wheat by operation size are investigated. Plans for a detailed study are discussed. Per acre costs, returns and investments are \$1.84, \$7.28 and \$65.55 for forage production and \$28.50, \$7.94 and \$153.40 for wheat production. As seen from these synthesized budgets, both enterprises yield a pure economic loss. Ignoring machinery depreciation and other implicit costs, wheat production provides a higher return above case cost than forage production. Costs of soil and water losses, labor, investment interest, depreciation and improvements are generally not considered. Tables include forage and wheat production budgets. Photos show land in wheat and forage production, and wheat-production machinery. (Popkin-Arizona)

W71-01297

PREDICTION OF CROP YIELDS FROM QUANTITY AND SALINITY OF IRRIGATION WATER,

New Mexico State Univ., University Park. Dept. of Agronomy.

For primary bibliographic entry see Field 03C.

W71-01299

THE ECONOMIC POSSIBILITY OF ADAPTING NEW TECHNOLOGY IN SPRINKLER IRRIGATION TO THE GREEN RIVER BASIN,

Wyoming Univ., Laramie. Div of Agricultural Economics.

Richard J. Taggart.

Master of Science Thesis, Division of Agriculture Economics, University of Wyoming, Oct. 1969. 68 p., 27 tab, 8 fig, 15 ref. OWRR Project A-001-WYO (27).

Descriptors: *Sprinkler irrigation, Irrigation efficiency, Budgeting, Cost comparisons, Surface irrigation, Wyoming.

Identifiers: *Green River Basin, Seedskaadee Pilot Farm.

The relative advantages are discussed of employing sprinkler type irrigation systems as compared to surface systems in the Green River Basin in southwestern Wyoming. Using the budgeting method of analysis, the costs for installing and operating two types of sprinkler systems, namely hydraulic and electric, are compared to the costs of surface irrigation. The author concludes that sprinkler irrigation, although requiring higher operational and maintenance costs, is more economic to use than surface irrigation because the increase in yields from sprinkler irrigation raises net income substantially. (Holmes-Rutgers)

W71-01350

UTILITIES: NEW TECHNIQUES, AND THEIR APPLICATION TO THE MUSKEGON COUNTY AREA, A WORKING PAPER REPORT.

Sheaffer (John R.) and Associates, Wheaton, Ill.

For primary bibliographic entry see Field 05D.

W71-01372

IRRIGATION TIMING AND AMOUNTS,

MacQuarie Univ., Sydney (Australia).

E. T. Linacre, and M. R. Till.

J Aust Inst Agr Sci, Vol 35, No 3, p 175-196, Sept 1969. 22 p., 269 ref.

Descriptors: Irrigation, *Irrigation efficiency, Irrigation water, *Irrigation practices, *Timing, Moisture stress, Soil moisture, *Rates of application, Evaporation pans, Atmometers, Water delivery, Water requirements, Bibliographies.

Identifiers: *Water budget, *Available moisture capacity, Irrigation requirement, Evaporimeters, Pan evaporation.

Irrigation water should be applied at the right time and in the proper amount to maintain crop growth and produce maximum crop yields. Skilled farmers' decisions on timing and amount of irrigation may produce the same yields as calculated timing. The shortage of water and greater emphasis on crop quality may require increasingly sophisticated farming with more exact irrigation timing. This review deals with the determination of when irrigation is due, particularly by the use of soil-moisture tension meters or sorption blocks, or by water budgeting. The instruments show indirectly when the crop suffers water stress, are useful for high-value crops, and are simple and suitable for farm use. Water budgeting involves keeping a running tally of inputs and losses of water from the soil within the root zone; the crop is watered when the balance of moisture in the soil falls below some critical value. Several approximations are involved, making it unnecessary to estimate crop evaporation with great accuracy. This component of the budget can be derived from measurements with an evaporimeter or atmometer or from some formula such as the Penman. Accounts are given of advisory schemes, operated by central agencies in various parts of the world, to aid the farmer in planning irrigation timing and amounts. (USBR)

W71-01386

PERFORMANCE OF WINTER WHEAT VARIETIES UNDER DRYLAND AND IRRIGATED

Field 03—WATER SUPPLY AUGMENTATION AND CONSERVATION

Group 3F—Conservation in Agriculture

CONDITIONS, PLAINS BRANCH STATION, 1959-1966,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 02I.
W71-01396

FERTILIZATION OF IRRIGATED GRAIN SORGHUM, NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 02I.
W71-01397

PLEISTOCENE NICHES FOR ALIEN ANIMALS,
Arizona Univ., Tucson. Dept. of Geochronology. Paul S. Martin.

From a symposium 'Pleistocene Man-Environmental Relationships', held at VIII Congress of the International Association for Quaternary Research (INQUA), Boulder, Colorado, 1965. BioScience, Vol 20, No 4, p 218-221, 15 February 1970. 2 fig, 2 tab, 22 ref.

Descriptors: *Pleistocene epoch, *Herbivores, *Niches, *Arid land, *Productivity, Ecosystems, Habitats, Mammals, Xerophilic animals, Ruminants, Big game, Xerophytes, Wildlife management, Ecology, Shrubs, Biological communities, Range management, Arizona, Biomass, Mexico.
Identifiers: *African herbivores.

Recent studies in a typical Arizona desert shrub community showed that of a productivity of 1400 kg/ha/yr, 900 kg/ha were inedible for cattle. Five times as many cattle were supported on an adjacent grassland with about the same precipitation, even though the productivity of the desert shrub community was greater. Clearly the cow, a grass-prefering, water-dependent herbivore is ill-adapted to western ranges which have little of either. The author argues for selective, careful studies on the introduction of African herbivores to these arid areas. In answer to the objection that they may wreak ecological destruction, owing to their lack of adaptation to these areas, several points are made: (1) the past biomass of the southwest was much greater than it is now; (2) during the Pleistocene, a wave of extinctions occurred; (3) these extinctions were mainly large herbivores closely related or identical to extant African herbivores, (4) the vacated niches have never been filled and (5) introduction of at least some of these animals into the southwestern U.S. may very well be into niches for which they are preadapted. A plea is therefore made for conservation of potentially useful African animal gene banks. (Casey-Arizona)
W71-01402

SELECTIVE CONTROL OF PLAINS PRICKLYPEAR IN RANGELAND WITH HERBICIDES,
Nebraska Univ., Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 03B.
W71-01408

SOIL MOISTURE AND EFFECTIVENESS OF PREEMERGENCE HERBICIDES,
Illinois Univ., Urbana; and Danville Junior Coll., Ill.
For primary bibliographic entry see Field 02I.
W71-01409

SPECTRAL SURVEY OF IRRIGATED REGIONAL CROPS AND SOILS ANNUAL REPORT, 1 OCT. 1968-30 SEP. 1969.
Agricultural Research Service, Weslaco, Tex.
For primary bibliographic entry see Field 07B.
W71-01539

HYDRAULICS OF LOW-GRADIENT BORDER IRRIGATION SYSTEMS,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 02G.
W71-01545

HEARINGS AND REPORT ON DRAINAGE OF WETLANDS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.
For primary bibliographic entry see Field 06E.
W71-01636

04. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control of Water on the Surface

MAN, AND STREAMFLOW MODIFICATION,
Oregon State Univ., Corvallis. Water Resources Research Inst. John C. Campbell.

Paper No 69-216 presented at 1969 Annual Meeting American Society of Agricultural Engineers, Purdue Univ., W Lafayette, Indiana, June 22-25, 1969. 13 p, 5 fig, 2 ref. OWRR Project No A-001-ORE (4).

Descriptors: *Regulated flow, *Streamflow, *Water demand, *Human population, *Water supply, Water shortage, Rivers, Reservoirs, Water yield, Flood control, Flow augmentation.
Identifiers: Seasonal rainfall.

This presentation deals with Man and his fresh water supply, its shortages and excesses, and concerns more specifically the modification of streamflow to bring about a more timely distribution of water for the benefit of mankind. The problem is not concerning water per se but the involvement of people-caused water situations resulting from increasing occupancy of the earth's surface in concentrated and often unplanned patterns. The problem is identified as one of water shortages and water excesses with occurrences of both on a seasonal basis appearing in most geographic areas. Since our hydrologic patterns do not change greatly over the centuries, the increasing problems must be the responsibility of Man himself, his changing habits, growing numbers, urbanization, technological advances, and the like. The author concludes that high reservoir systems for water storage can be utilized to retain 25 to 100 percent of annual water yield for later release. (Woodard-USGS)
W71-01114

SLOSS SHEFFIELD STEEL AND IRON CO V NANCE (LIABILITY FOR BLOCKING NATURAL DRAINAGE OF SURFACE WATERS).
For primary bibliographic entry see Field 06E.
W71-01122

HAWKEYE PORTLAND CEMENT CO V WILIAMS (EASEMENTS FOR WATER SUPPLY).
For primary bibliographic entry see Field 06E.
W71-01123

EROSION AND RIPRAP REQUIREMENTS AT CULVERT AND STORM-DRAIN OUTLETS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
For primary bibliographic entry see Field 08A.
W71-01126

SHEMME V KRAMER (LIABILITY FOR DIVERSION OF SURFACE WATER).
For primary bibliographic entry see Field 06E.
W71-01134

CREECH V UNITED STATES (IMPERVIOUS LEVEE NOT THE CAUSE OF OVERFLOW AND INCREASED WIND TIDES).
For primary bibliographic entry see Field 06E.
W71-01138

PERE MARQUETTE RY V SIEGLE (LIABILITY FOR INTERFERENCE WITH ICE BUSINESS BY DAM OPERATION).
For primary bibliographic entry see Field 06E.
W71-01150

ZAMANI V OTTER TAIL POWER CO (STATUTE OF LIMITATIONS FOR FLOOD DAMAGE ACTIONS).
For primary bibliographic entry see Field 06E.
W71-01153

PAHL V LONG MEADOW GUN CLUB (ACQUISITION OF PRESCRIPTIVE RIGHT TO FLOOD).
For primary bibliographic entry see Field 06E.
W71-01155

SMITH V GEORGIA POWER CO (LIABILITY FOR FLOODING OF FARM BY OVERFLOW OF DAM).
For primary bibliographic entry see Field 06E.
W71-01158

EROSION PROTECTION FOR THE OUTLET OF SMALL AND MEDIUM CULVERTS,
South Dakota State Univ., Brookings. Fred M. Chang, and Mansour Karim.
Available from NTIS as PB-190 565, \$3.00 in paper copy, \$0.95 in microfiche. February 1970, 52 p.
Identifiers: *Roads, Drainage, *Erosion, Control systems, Feasibility studies, Gravel, Walls, Model tests, Fluid flow, Design, Culverts, Scour, Stilling basins.

The study is conducted as a pilot study to investigate and evaluate the feasibility of an erosion control work for the outlet of small and median culverts. The proposed control work consists of a recessed stilling basin armored with gravel and a transverse impact wall. The primary objectives of the investigation were to find the dimensions of the stilling basin and a proper location of the impact wall for the design flow discharge for two tail water conditions; namely low tailwater condition simulating a discharge onto an open ground and high tailwater condition simulating a discharge into a receiving channel. Two things were of main concern: (1) no further deterioration of the basin that may initiate erosion on highway grade and finally it brings total failure, and (2) minimization of scour below the impact wall.
W71-01173

INVESTIGATION OF AIRFIELD DRAINAGE, ARCTIC AND SUBARCTIC REGIONS, PART I. FIELD RECONNAISSANCE AND ANALYSIS,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab. Lorenz G. Straub, and Loyal A. Johnson.
Available from NTIS as AD-703 392, \$3.00 in paper copy, \$0.95 in microfiche. Aug 1950, 173 p.
Identifiers: *Construction, Arctic regions, *Landing fields, Drainage, *Arctic regions, Landing fields, Structures, Design, Runways, Floods, Erosion, Pipes, Climatology, Rainfall, Intensity, Terrain, Maintenance, Military facilities, Rivers, Fluid flow, Ice, Alaska, Groundwater, Surface water runoff, Culverts.

The ultimate aim of the investigations and studies is the determination of design, construction, and maintenance procedures suitable for the drainage of airfields located in arctic and subarctic regions. The report is intended to summarize the outcome of a field investigation of selected sites in Alaska. (See also W71-01177)
W71-01176

INVESTIGATION OF AIRFIELD DRAINAGE, ARCTIC AND SUBARCTIC REGIONS, PART II. TRANSLATIONS OF SELECTED TOPICS, Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab. Meir Pilch.

Available from NTIS as AD-462 973, \$3.00 in paper copy, \$0.95 in microfiche. April 1949, 148 p, Report, No 17. W-21-018-eng-430.

Identifiers: *Landing fields, Drainage, Moistureproofing, Abstracts, Processing, USSR, Permafrost, Soil mechanics, Engineering geology, Structural geology, Ice, Arctic region, Countermeasures, Reviews.

The report is a collection of translations of selected topics from three Russian sources and is composed of three parts. The first part, waterproofing and drainage of defense and nondefense structures, is an exact translation, including six chapters. The next part, abstracts of scientific research work for 1945. Obruchev Institute of Frost Science, also is an exact translation; it includes only that section of the original manuscript which contains the reports of the Institute of Frost Science. The last part, icings and countermeasures is a detailed abstract of the original text. (See also W71-01176)
W71-01177

USE OF STOCHASTIC HYDROLOGY TO DETERMINE STORAGE REQUIREMENTS FOR RESERVOIRS -- A CRITICAL ANALYSIS, Stanford Univ., Calif. Program in Engineering Economic Planning.
For primary bibliographic entry see Field 06A.
W71-01188

CHANGES IN WATER ENVIRONMENT RESULTING FROM AQUATIC PLANT CONTROL, Wisconsin Univ., Madison. Water Resources Center. Grant Cottam, and Stanley A. Nichols.
Available from NTIS as PB-195 671, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report OWRR B-019-Wis, Wisconsin Water Resources Center, July 1970. 27 p, 9 tab, 2 fig, 4 ref. OWRR B-019-Wis (2).

Descriptors: *Harvesting of algae, *Aquatic weeds, *Growth rates, *Shallow water, *Life cycle, Potamogeton, Vallisneria, Myriophyllum spicatum, Myriophyllum exaltescens, Filamentous algae, Macrophytes, Wisconsin.
Identifiers: University Bay (Wisc), Lake Mendota (Wisc), SCUBA equipment.

The effect of harvesting aquatic macrophytes was studied over a three year period by means of two plots, each 30 m by 30 m located in University Bay on Lake Mendota, Wisconsin. The plots were subdivided into nine compartments and were treated as follows: (1) Harvested 3 times, in June, July, and August; (2) Harvested twice; (a) in June and July; (b) in July and August; (3) Harvested once; (a) in June; (b) in July; (c) in August. These plots and their controls, were sampled four times, in June, July, August, and September. Sampling was done with SCUBA apparatus. The plants were cut six inches (15 cm.) above the bottom surface and were weighed and measured. The results indicate that one harvesting will reduce the amount of regrowth to about 50% of that of the controls, two harvests will result in about 75% reduction, and three harvests almost totally eliminated the plants for that year. Recommendations for harvesting heavily used areas are two harvests, one in mid June, and

the other in July. August harvesting is not necessary in this climate, since the plants tend to break up regardless of treatment. None of the treatments had an appreciable effect on the subsequent years growth, even after two years of harvesting three times.

W71-01196

PROCESSING CHARACTERISTICS OF SUB-SURFACE MACROPHYTES OF MADISON, WISCONSIN LAKES IN RELATION TO MECHANICAL HARVESTING SYSTEMS, Wisconsin Univ., Madison. Water Resources Center.

D. F. Livermore, H. D. Bruhn, and B. W. Pollock.
Available from NTIS as PB-195 672, \$3.00 in paper copy, \$0.95 in microfiche. Technical Paper OWRR B-018-Wis, presented at IBP UNESCO meeting on Production, Ecology, and Hydrological Implications of Aquatic Macrophytes, Sept. 1-10, 1970, Rumania, 1970. 12 p, 12 fig. OWRR B-018-Wis (1).

Descriptors: *Aquatic weed control, *Harvesting of algae, *Dewatering, Harvesting rates, Compressing, Calorimeter tests, Processing harvested material, Mechanical harvesting, Wisconsin.
Identifiers: Madison, Wisconsin Lakes.

Equipment has been developed to harvest subsurface macrophytes to depths of one to one and one-half meters, thus freeing the lake subsurface for boating and other recreational purposes without seriously disturbing the vegetation and fish habitat at greater depth. To facilitate handling and reduce operating costs, research was conducted on numerous methods of vegetation processing. Two methods of processing were found to offer possibilities in converting aquatic vegetation to a state more readily handled and transported. Fluidizing by intensive chopping and grinding reduces the vegetation to a slurry which can then be handled and transported as a fluid. A second alternative is mechanically dewatering the vegetation by chopping and pressing. The fluid fraction is returned to the body of water while press residue is reduced to 12 to 16% of the original volume and 23 to 32% of its original weight. Approximately 90% of the original solids, 85% of the protein, 60% of the potassium, and 80% of the phosphorus present in the vegetation as harvested is removed in the press residue. The effects of returning the liquid fraction to the body of water are not known.
W71-01197

GARMANY V SOUTHERN RY (LIABILITY FOR DISCHARGE OF ACCUMULATED SURFACE WATERS),
For primary bibliographic entry see Field 06E.
W71-01209

EXPERIENCE WITH THE MATHEMATICAL MODEL OF THE HYDRAULIC NETWORK OF RIJNLAND WATER BOARD, Waterloopkundig Laboratorium, Delft (Netherlands).
For primary bibliographic entry see Field 06A.
W71-01227

FLOOD FORECAST AND FLOOD CONTROL BY COMPUTER, Ministry of Construction, Morioka (Japan). Yoshiharu Ida, Tadashi Kiya, and Ken-ichi Sasaki.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 413-420, 1969. 8 p, 12 fig, 2 photo, 1 tab.

Descriptors: *Flood routing, *Reservoir operation, *Computer programs, *Water management (Applied), Digital computers, Analog computers, Flood control, Reservoirs, Routing, Flood forecasting, Streamflow forecasting.
Identifiers: Hybrid computers.

Digital computers are effective in flood forecasting in which flood control is by river dams. Flood forecasting using digital computers in the Kitakami River, Japan, is in practical use in control of streamflow, making flood forecasts, and dam control. Hybrid computer systems, combinations of the elements of the digital computer, and the elements of the analogue computer are also being used. (Knapp-USGS)
W71-01229

A STOCHASTIC MODEL TO SIMULATE MONTHLY RIVER FLOW SEQUENCES, Osaka Univ. (Japan). Hydraulics Lab. Akira Murota, and Toru Kanda.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Hyoto, p 163-170, 1969. 8 p, 7 fig, 2 tab, 3 ref.

Descriptors: *Synthetic hydrology, *Stochastic processes, *Streamflow forecasting, *Rainfall-runoff relationships, Sampling, Simulation analysis, Low flow, Peak discharge, Regression analysis, Hydrograph analysis.
Identifiers: Japan, Stochastic hydrology.

Stochastic analyses were performed of the monthly river flow records of 48 years in the Kizu River Basin, Japan. The Pearson Type III distributions provide a good fit. Normalization of the distribution functions of observed flows is used in preparation of subsequent studies of synthesis of river flow sequences. Stratified sampling techniques are applied in order to discriminate between serial correlations of high flows and of low flows of consecutive months. By use of the obtained statistical parameters of high-flow and low-flow population, 200 years of monthly river flows were synthesized. To verify the applicability of the proposed model, properties of synthesized river flow sequences were compared with those of the flow sequences observed and also synthesized by the usual linear regression mode. The proposed model replicated the persistency of low flows and randomness of high flows in good agreement with observations. (Knapp-USGS)
W71-01233

A NEW RATIONAL METHOD FOR CALCULATION OF MAXIMUM FLOOD DISCHARGE BY AMOUNT OF RAINFALL IN THE CATCHMENT, Seoul National Univ. (Republic of Korea). Dept. of Civil Engineering.
For primary bibliographic entry see Field 02E.
W71-01234

ASHLEY V HOLDBERT (LANDOWNER'S LIABILITY FOR ROCKSLIDE DAMAGE CAUSED BY FAILURE TO MAINTAIN CLEAR CHANNEL FOR NATURAL DRAINAGE),
For primary bibliographic entry see Field 06E.
W71-01249

NOBLE V ECHO LAKE TAVERN, INC (RIGHT TO DRAW WATER AND TITLE TO LAKE BED: DEED INTERPRETATION),
For primary bibliographic entry see Field 06E.
W71-01269

HORTON V NIAGARA, LOCKPORT AND ONTARIO POWER CO (EVIDENCE OF HIGH WATER MARK AND TITLE TO BEDS),
For primary bibliographic entry see Field 06E.
W71-01278

BULL V STATE (LOWER PROPRIETOR NOT LIABLE FOR GRADE CHANGES WHICH REPULSE SURFACE WATER),
For primary bibliographic entry see Field 06E.
W71-01282

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

KELLOGG V ILLINOIS CENT RR (LIABILITY FOR OVERFLOW OF DRAINAGE DITCH).

For primary bibliographic entry see Field 06E.
W71-01296

FLOOD PLAIN INFORMATION, TARRANT AND JOHNSON COUNTIES, TEXAS. Corps of Engineers, Fort Worth, Tex.

Corps of Engineers Flood Plain Report, June 1970.
29 p, 4 fig, 16 plate, 11 tab.

Descriptors: *Floods, *Flood damage, *Texas, Flood plains, Regional flood, Flood forecasting, Flood control.
Identifiers: *Flood records, *Village Creek (Tarrant and Johnson Counties, Tex.), Standard project flood, Intermediate regional flood.

Flooding along Village Creek in Tarrant and Johnson Counties, Texas above Lake Arlington is described to aid in solving local flood problems and in planning the best utilization of flood-prone lands. Maps, profiles, cross sections, and text material relating the extent of past flooding to floods which might occur in the future are based on available records of rainfall runoff, historical flood heights, and other technical data. (Woodard-USGS)
W71-01329

STORM SEWER SYSTEMS, FACILITIES NEEDED, 1966-1975, American Public Works Association, Chicago, Ill. Research Foundation. Herbert G. Poertner. American Public Works Association Research Foundation Report, May 1966. 46 p, 3 fig, 7 tab, 9 ref.

Descriptors: *Storm drains, *Sewers, *Sewerage, *Storm runoff, *Urbanization, *Investment, *Capital costs, *Construction costs, *Financing, *Expenditures, Public benefits, History, Annual costs, Land development, United States.
Identifiers: *Storm sewers, *Combined sewers, *Capital requirements, United States Congress.

Capital investments are reported in urban storm sewer systems in the United States, descriptions of trends, and estimates of annual capital needs during the decade 1966-1975. Statistical data were obtained in three surveys of urban areas made in 1965-1966 by the American Public Works Association. It was estimated that the total investment in storm sewers and combined sewers is \$22 billion, based on 1965 costs, and that \$25 billion will be required to construct new sewers, increase capacities of existing systems, and separate combined sewers in some urban areas. Local governments are expected to expend \$16 billion. Private land developers would expend \$9 billion for storm sewers in newly developed urban areas. Funds required for drainage facilities along highways, and roads and at airports, are not included. Seven tables are included to categorize capital investments, expenditures, capital needs and sources of financing by states and population groups. The report was prepared for the Subcommittee on Economic Progress of the Joint Economic Committee of the United States Congress. The publication includes discussions of the characteristics, fundamentals, principles, performance standards, economic costs, construction costs, user charges, and benefits of storm sewer systems. (Poertner)
W71-01335

SOME EFFECTS OF URBANIZATION ON FLOODS, Illinois State Water Survey, Urbana. For primary bibliographic entry see Field 04C. W71-01336

MANITOBA HYDRO CHURCHILL RIVER DIVERSION, STUDY OF ALTERNATIVE DIVERSIONS, A MATHEMATICAL MODEL. Underwood, McLellan and Associates Ltd., Winnipeg (Manitoba).

Report to Manitoba Hydro, April 1970. 109 p, 25 fig, 3 tab, 5 ref.

Descriptors: *Model studies, *Computer models, *Diversion, *Hydraulic models, *River flow, Hydromechanics, Hydraulic structures, Diversion structures, Reservoirs, Control structures, Hydrologic models, Hydraulic similitude, Regulated flow.
Identifiers: *River diversion, Churchill River, Nelson River, Canada.

This study was directed toward the determination of optimized costs of diverting flow at various rates from Canada's Churchill River into the Nelson River basin via the Rat and Burntwood Rivers. The physical system investigated included: three possible interconnecting reservoir sites, two possible diversion points, an overflow structure for level control at Granville Lake, and two control channels terminating at Notigi Lake. Diversion would be via Suwanne Lake by gravity flow, and/or via Rat River by gravity flow or pumping from South Bay. The optimization program included the potential losses in resource values that would result from the development of reservoirs and other related structures for the diversion, as well as the actual construction costs. The optimal solutions were to provide information concerning: (1) which reservoirs should be developed and to what extent, subject to various constraints; and (2) the live storages that would be needed for producing flow rates for the critical period hydrology. In the mathematical study, all non-linear functions were transformed into piece-wise linear functions of small intervals so that the essential features of non-linear functional representation were preserved. The separable programming technique and algorithm of the mathematical programming system of IBM/360 was used to handle non-linear separable functions. The computer program and three typical solutions from the operation of the model are included in the publication. (Poertner)
W71-01338

MINNIE CREEK DRAINAGE DIST V STREETER (ANNEXATION OF LANDS TO DRAINAGE DISTRICT). For primary bibliographic entry see Field 06E. W71-01356

QUALITY OF STORMWATER DRAINAGE FROM URBAN LAND AREAS IN NORTH CAROLINA. North Carolina Water Resources Research Inst., Raleigh. For primary bibliographic entry see Field 05G. W71-01360

PERKINS V VERMONT HYDRO-ELECTRIC CORP (LIABILITY FOR FLOOD DAMAGE). For primary bibliographic entry see Field 06E. W71-01361

GRAHAM V SAFE HARBOR WATER POWER CORP (DURATION OF FLOOD RIGHTS). For primary bibliographic entry see Field 06E. W71-01362

MECHANICAL EQUIPMENT FOR FIELD DRAINAGE AND DITCHING, Ministry of Agriculture, Fisheries and Food, London (England). C. Culpin. Work Pap No 51, AGRI/WP.2, Econ Comm Eur, Comm Agr Probl, Feb 1970. 36 p, 19 fig, 5 tab, append. W71-01363

Descriptors: *Drainage practices, *Drainage systems, Drainage water, Drains, Drain tiles, *Drainage, Agriculture, *Foreign design practices, Trenches, Costs, Mole drainage, Mole drains, Ditches, Draglines, Excavators, Underdrains, Sub-surface drains, Construction equipment, Irrigation operation and maintenance.
Identifiers: Great Britain, France, Drain spacing, Pipe laying, Open drains, Construction methods.

Drainage of individual agricultural fields is necessary in wet climates. This may be done either by an underground drain or open ditches, or by a combination of both. Mechanical equipment used for installing and maintaining farm drains is discussed. Drainage needs vary in different countries, but few fundamental differences exist in basic needs. Drainage practices of individual countries are summarized. Types of drains, such as clay tile, plastic pipe, concrete pipe, open ditches, timber box drains, mole drains, typical spacings and depths used, and method and machinery used for installation are reviewed. Installation and operating costs of farm drainage in Great Britain and France are given. (USBR)
W71-01380

PRESTON V CLARK (UPPER RIPARIAN OWNER'S RIGHT TO MAINTAIN DAM). For primary bibliographic entry see Field 06E. W71-01413

BROWN V STATE (CANAL CONSTRUCTION AS A CONTRIBUTORY CAUSE OF FLOODING). For primary bibliographic entry see Field 06E. W71-01424

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (RIPARIAN RIGHT TO DIVERT THE WATERS OF A NAVIGABLE RIVER). For primary bibliographic entry see Field 06E. W71-01425

BRAEBURN ALLOY STEEL CORP V UNITED STATES (GOVERNMENT'S LIABILITY FOR DAMAGES CAUSED BY UNPRECEDENTED FLOOD). For primary bibliographic entry see Field 06E. W71-01429

RODEN COAL CO V UNITED STATES (GOVERNMENT'S LIABILITY FOR SUBSIDENCE DAMAGE CAUSED BY CHANNEL DREDGING). For primary bibliographic entry see Field 06E. W71-01430

CITY OF ROME V BROWN (DAMAGES FOR PONDING CAUSED BY MUNICIPAL IMPROVEMENTS). For primary bibliographic entry see Field 06E. W71-01436

CITY OF ROME V BROWN (DAMAGES FOR PONDING CAUSED BY MUNICIPAL IMPROVEMENTS). For primary bibliographic entry see Field 06E. W71-01438

STURGES V SCHOOL DISTRICT (LIABILITY FOR DIVERTING NATURAL FLOW OF WATER ONTO ANOTHER'S LAND). For primary bibliographic entry see Field 06E. W71-01461

SGARLATA V CITY OF SCHENECTADY (CITY'S LIABILITY FOR FLOOD DAMAGE

Control of Water on the Surface—Group 4A

CAUSED BY STREAM BEING BACKED UP BY OBSTRUCTED CULVERT).

For primary bibliographic entry see Field 06E.
W71-01471

KEARNS V TOWN OF BLOOMFIELD (PRESCRIPTIVE RIGHT TO USE DRAINAGE DITCH OVER PRIVATE PROPERTY).

For primary bibliographic entry see Field 06E.
W71-01492

URBAN DRAINAGE AS A FACTOR IN EUTROPHICATION,

Public Health Service, Washington, D.C.
For primary bibliographic entry see Field 05C.
W71-01500

WATER PERMEABILITY OF FROZEN SAND,

Snow Ice and Permafrost Research Establishment, Wilmette, Ill.
For primary bibliographic entry see Field 02G.
W71-01505

WATSON V CHESAPEAKE AND OHIO RY (RAILROAD'S LIABILITY FOR CHANGING SURFACE DRAINAGE BY ELEVATING TRACKS).

For primary bibliographic entry see Field 06E.
W71-01518

ST LOUIS SAN FRANCISCO RY V MANNING (RAILROAD'S LIABILITY FOR DESTROYING NATURAL PROTECTION FROM RIVER OVERFLOW).

For primary bibliographic entry see Field 06E.
W71-01519

JOHNSON V RATLIFF (LIABILITY FOR DIVERSION OF SURFACE DRAINAGE).

For primary bibliographic entry see Field 06E.
W71-01520

BARRILLEAUX V DELAUNE (LIABILITY FOR LEVEE OBSTRUCTING DRAINAGE SERVITUDE).

For primary bibliographic entry see Field 06E.
W71-01536

EFFECTS OF METHOD B BACKFILL ON FLEXIBLE CULVERTS UNDER HIGH FILLS: CHADD CREEK VOLUME 2 (APPENDICES),

California State Div. of Highways. Bridge Dept. Raymond E. Davis.
Available from NTIS as PB-188 624, \$3.00 in paper copy, \$0.95 in microfiche. Cal. State Div. of Highways Report No R/D-4-69, October 1969. 354 p.
Identifiers: *Pipes, Drainage, *Roads, Structural properties, Flexible structures, Data, Foundations (Structures), Soil mechanics, Straw, Stresses, Strain (Mechanics), Moments, Thrust, Filling, Culverts, Corrugated metal pipes.

The volume contains appendixes of data, theoretical analysis and calculations of corrugated section properties.
W71-01540

WATER LAW'S DOUBLE ENVIRONMENT: HOW WATER LAW DOCTRINES IMPEDE THE ATTAINMENT OF ENVIRONMENTAL ENHANCEMENT GOALS,

For primary bibliographic entry see Field 06E.
W71-01547

WATER LAW IN SOUTHEASTERN WISCONSIN (WATERSHED MANAGEMENT AND POLLUTION CONTROL).

Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.

W71-01551

HEWITT V PERRY (REASONABLE USE OF RECREATIONAL EASEMENT).

For primary bibliographic entry see Field 06E.
W71-01563

BOWERS V PRICE (LIABILITY FOR INCREASE OF NATURAL FLOW BY DOMINANT ESTATE).

For primary bibliographic entry see Field 06E.
W71-01568

UNITED STATES V BIG BEND TRANSIT CO (TITLE TO CONDEMNED LAND ON INDIAN RESERVATION).

For primary bibliographic entry see Field 06E.
W71-01573

GARLAND LEVEE DIST V HUTT (LEVEE DISTRICT'S LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF LEVEE).

For primary bibliographic entry see Field 06E.
W71-01576

I. COMPREHENSIVE PLAN FOR THE FOX RIVER WATERSHED, CH 14 (SURVEY OF LEGAL ASPECTS OF WATERSHED DEVELOPMENT).

For primary bibliographic entry see Field 06E.
W71-01578

ROE V CITY OF MIDDLETOWN (MUNICIPALITY'S LIABILITY FOR DAMAGE RESULTING FROM FILLING OF CHANNEL).

For primary bibliographic entry see Field 06E.
W71-01579

HUMPICH'S TRUSTEES V LOUISVILLE GAS AND ELEC CO (POWER COMPANY'S LIABILITY FOR BACKWATER FLOODING CAUSED BY FEDERAL DAM PROJECT).

For primary bibliographic entry see Field 06E.
W71-01585

SHARP V LEARNED (BOUNDARY BETWEEN STATES WHEN THE RIVER THREAD CHANGES).

For primary bibliographic entry see Field 06E.
W71-01589

CAPLES V TALIAFERRO (OWNERSHIP OF SUBMERGED LANDS).

For primary bibliographic entry see Field 06E.
W71-01590

STRECKFUS STEAMERS, INC V FOX (RIGHT OF STATE TO TAX SALES ABOARD STEAMBOAT IN NAVIGABLE RIVER).

For primary bibliographic entry see Field 06E.
W71-01594

METZ V HOFFMAN (UNLAWFUL OBSTRUCTION TO STREAMFLOW).

For primary bibliographic entry see Field 06E.
W71-01600

WEST PENN RY V UMBEL (PROPERTY DAMAGE RESULTING FROM ROCK SLIDE; NEGLIGENCE IN CONTAINMENT OF WATER).

For primary bibliographic entry see Field 06E.
W71-01601

COMMONWEALTH EX REL MARGIOTTI V DELAWARE DIV CANAL CO (CANAL OWNERSHIP AS AFFECTED BY BREACH OF COVENANT TO MAINTAIN AS A CANAL).

For primary bibliographic entry see Field 06E.

W71-01603

FURJANIC V METROPOLITAN EDISON CO (RELIEF FROM CANAL OVERFLOW BARRED BY LACHES).

For primary bibliographic entry see Field 06E.
W71-01604

STATE EX REL O'CONNOR V SORENSON (NEW PROPERTY BOUNDARY CAUSED BY NEW HIGH WATER MARK WHEN RIVER WAS DAMMED).

For primary bibliographic entry see Field 06E.
W71-01606

WILKINSON V CITY OF INDIANOLA (OVERFLOW OF CITY SEWAGE SYSTEM).

For primary bibliographic entry see Field 06E.
W71-01608

STATE V M SUPPLE AND SONS CO (STATE INTERFERENCE WITH CONSTRUCTION OF BULKHEAD NOT IN NAVIGABLE WATERS).

For primary bibliographic entry see Field 06E.
W71-01610

LATHAM V DES MOINES ELECTRIC LIGHT CO (WATER DAMAGE CAUSED BY BURSTING STORM SEWER).

For primary bibliographic entry see Field 06E.
W71-01611

HUERTH V TOWN OF PRAIRIE DU SAC (JURY QUESTION AS TO WHETHER STATUTORY REQUIREMENTS WERE MET RELATING TO PROPER DRAINAGE).

For primary bibliographic entry see Field 06E.
W71-01614

STATE V KNOWLES-LOMBARD CO (USE OF LAND BETWEEN HIGH AND LOW WATER MARKS).

For primary bibliographic entry see Field 06E.
W71-01616

CAHILL V MAYOR AND CITY COUNCIL OF BALTIMORE (PERMIT TO CONSTRUCT WHARF INTO NAVIGABLE RIVER).

For primary bibliographic entry see Field 06E.
W71-01617

GRAY V GRAY (VALIDITY OF LAND PATENTS UNDER NAVIGABLE STREAMS).

For primary bibliographic entry see Field 06E.
W71-01618

STATE V MALMQUIST (DAM OWNER'S DRAWDOWN OF LAKE AS NUISANCE).

For primary bibliographic entry see Field 06E.
W71-01622

HERSHEY BEVERAGE CORP V CITY OF SCHENECTADY (MUNICIPAL LIABILITY FOR FLOOD DAMAGES).

For primary bibliographic entry see Field 06E.
W71-01625

MAYO V WINDELS (DAMAGES FOR WATER DIVERSION).

For primary bibliographic entry see Field 06E.
W71-01626

APPLICATION OF GILLESPIE (COMPENSATION TO NEIGHBORING LANDOWNER FOR CONSTRUCTION OF AQUEDUCT).

For primary bibliographic entry see Field 06E.
W71-01627

Field 04—WATER QUANTITY MANAGEMENT AND CONTROL

Group 4A—Control of Water on the Surface

ROCKLAND LIGHT AND POWER CO V CITY OF NEW YORK (DAMAGES PRESENTLY RECOVERABLE AS DEDUCTIBLE FROM TOTAL DAMAGES SUFFERED BY WATER DIVERSION).

For primary bibliographic entry see Field 06E.
W71-01628

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONGRESS, 2ND SESSION.

For primary bibliographic entry see Field 06E.
W71-01633

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 2ND SESSION.

For primary bibliographic entry see Field 06E.
W71-01634

HEARINGS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT—WATERSHED PROJECTS, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.

For primary bibliographic entry see Field 06E.
W71-01635

BRADLEY V CITY OF MARLBORO (CITY'S LIABILITY FOR FLOODING CAUSED BY IMPROPERLY MAINTAINED CULVERT).

For primary bibliographic entry see Field 06E.
W71-01638

LYON V CITY OF BINGHAMTON (CITY'S LIABILITY FOR DIVERTING WATER AND FOR TAKING POSSESSION OF MILLDAM).

For primary bibliographic entry see Field 06E.
W71-01639

TALBERT V CITY OF WINCHESTER (FLOOD DAMAGE FROM DIVERTED SURFACE WATER).

For primary bibliographic entry see Field 06E.
W71-01641

CITY OF COVINGTON V MCKINNEY (OBSTRUCTION CAUSING OVERFLOW AS PERMANENT WHERE NOT REMEDIABLE AT REASONABLE EXPENSE).

For primary bibliographic entry see Field 06E.
W71-01642

DAVIS V IVEY (LIABILITY FOR ALTERING FLOW OF SURFACE DRAINAGE).

For primary bibliographic entry see Field 06E.
W71-01649

4B. Groundwater Management

A RECONNAISSANCE OF THE WATER RESOURCES IN THE PORTNEUF RIVER BASIN, IDAHO,

Geological Survey, Boise, Idaho.
For primary bibliographic entry see Field 02E.
W71-01104

THE USE OF LINEAR PROGRAMMING FOR ESTIMATING GEOHYDROLOGICAL PARAMETERS OF GROUNDWATER BASINS,

General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
For primary bibliographic entry see Field 02F.
W71-01193

MODELTESTS INVESTIGATING THE POSSIBILITIES OF ARTIFICIAL WATER STORAGE IN ALLUVIAL GROUNDS,

Stuttgart Univ., (West Germany).

Gunter W. Marotz.

French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 231-238, 1969. 8 p, 7 fig, 1 tab, 4 ref.

Descriptors: *Hydraulic models, *Infiltration, *Artificial recharge, *Injection wells, Flooding, Water spreading, Water management (Applied), Alluvial channels, Hydraulic similitude, Water storage, Conjunctive use, Underground storage.

Identifiers: Underground reservoirs.

The problems of underground water storage in alluvium were analyzed with the help of two hydraulic models. Observations over two years, which included repeated fillings and drainages, gave results on the percentage of the soil volume which can be filled with water. This percentage is a function of the soil structure, of atmospheric pressure, temperature, and other parameters. It was found that the air occlusions which become trapped in voids cause the main difficulties. Flood waters (which are particularly suited for filling underground reservoirs) often carry excessive amounts of suspended load, but the importance of underground storage as a means for water supply should not be underestimated. (Knapp-USGS)

W71-01216

MATHEMATICAL MODEL OF THE BIG BEND WELL FIELD,

Southwestern Ohio Water Co., Cincinnati; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.

For primary bibliographic entry see Field 02F.
W71-01236

WATER LAW IN SOUTHEASTERN WISCONSIN.

Wisconsin Univ., Madison.

For primary bibliographic entry see Field 06E.
W71-01549

WATER LAW IN SOUTHEASTERN WISCONSIN (RIPARIAN AND DIFFUSED SURFACE WATER LAW).

Wisconsin Univ., Madison.

For primary bibliographic entry see Field 06E.
W71-01550

4C. Effects on Water of Man's Non-Water Activities

BULL V STATE (LOWER PROPRIETOR NOT LIABLE FOR GRADE CHANGES WHICH REPULSE SURFACE WATER).

For primary bibliographic entry see Field 06E.
W71-01282

SAN FRANCISCO BAY-DELTA WATER QUALITY CONTROL PROGRAM.

Kaiser Engineers, Oakland, Calif.

For primary bibliographic entry see Field 05G.
W71-01333

SOME EFFECTS OF URBANIZATION ON FLOODS,

Illinois State Water Survey, Urbana.

John B. Stall, Michael L. Terstriep, and Floyd A. Huff.

Meeting Preprint 1130, a paper presented at the ASCE National Water Resources Meeting, Memphis, Tenn., January 26-30, 1970. American Society of Civil Engineers, New York, January 1970. 29 p, 11 fig, 10 tab, 22 ref.

Descriptors: *Surface runoff, *Storm runoff, *Rainfall-runoff relationships, *Peak discharge, *Urbanization, *Maximum probable flood, Unit hydrographs, Hydrograph analysis, Runoff, Model studies, Drainage effects, Floods, Illinois, Stream-flow forecasting, Drainage water, Permeability, Design storm, Design flood, Illinois, Cities.

Identifiers: *Effects of urbanization, Impervious area.

The objectives of the study were: (1) to attempt a better definition of the effects of urbanization on floods by using relatively good information available in Illinois on storm rainfall structure and frequency, and (2) to translate this into the resulting effect on the flood-frequency curve using a set of empirical equations developed in 1965 at the University of Texas Center For Research in Water Resources by Espy, Morgan, and Masch (A Study of Some Effects of Urbanization on Storm Runoff from a Small Watershed CRWR Technical Report HYD 07-6501 Austin, Texas 1965). The Texas equations were used as a transfer function from storm rainfall to flood peak. A model two-hour rainstorm, based on recorded precipitation data from East-Central Illinois, was developed for various recurrence intervals and applied to the completely urbanized, 3.5-square mile drainage area of Boneyard Creek at Urbana, Illinois. The specified model storm was applied to the derived unit hydrographs after determining the rainfall excess after losses. The empirical Texas equations seem adequate to produce a 30-minute unit hydrograph for the Boneyard basin and it checks favorably with actual unit hydrographs. The complete transformation of a 3.5-square mile rural basin, in East-Central Illinois, to an intensely urbanized basin would quadruple the flood peak for the 50-year recurrence interval; and the mean annual flood would increase by about eight times. (See also W69-02354). (Poertner)

W71-01336

THE EFFECT OF LAND UTILIZATION ON WATER QUALITY VARIATIONS,

Rutgers - The State Univ., New Brunswick, N.J. Dept. of Environmental Sciences.

For primary bibliographic entry see Field 05B.
W71-01345

SPECIAL CASES OF WATER SUPPLY INTERFERENCE CAUSED BY URBAN DEVELOPMENT NEAR TORONTO, ONTARIO, CANADA,

Ontario Water Resources Commission, Toronto.

For primary bibliographic entry see Field 02F.
W71-01363

VARIATION OF URBAN RUNOFF WITH DURATION AND INTENSITY OF STORMS,

Texas Tech Univ., Lubbock. Water Resources Center.

For primary bibliographic entry see Field 05B.
W71-01546

SMITH V STATE (VALUATION OF PROPERTY CONDEMNED FOR HIGHWAY RELOCATION AND FLOOD CONTROL PROJECT).

For primary bibliographic entry see Field 06E.
W71-01629

4D. Watershed Protection

EFFECTS OF SIMULATED CLOUD SEEDING ON STREAMFLOW OF SELECTED WATERSHEDS IN PENNSYLVANIA,

Pennsylvania State Univ., University Park. School of Forest Resources.

For primary bibliographic entry see Field 03B.
W71-01116

DESIGN CRITERIA FOR CONTROLLED SCOUR AND ENERGY DISSIPATION AT CULVERT OUTLETS USING ROCK AND SILL, South Dakota School of Mines and Technology, Rapid City.

For primary bibliographic entry see Field 08B.

W71-01119

WATERSHED MANAGEMENT AND SOIL EROSION PROBLEMS IN WEST PAKISTAN,

For primary bibliographic entry see Field 02J.

W71-01400

ON THE BIOLOGY OF THE DESERT TORTOISE TESTUDO SULCATA IN SUDAN, Khartoum Univ. (Sudan). Dept. of Zoology.

For primary bibliographic entry see Field 02I.

W71-01404

MIAMI CORP V STATE (STATE OWNERSHIP OF PROPERTY OF LAND SUBMERGED BY EROSION AND SUBSIDENCE).

For primary bibliographic entry see Field 06E.

W71-01444

WATER LAW IN SOUTHEASTERN WISCONSIN.

Wisconsin Univ., Madison.

For primary bibliographic entry see Field 06E.

W71-01549

WATER LAW IN SOUTHEASTERN WISCONSIN (RIPARIAN AND DIFFUSED SURFACE WATER LAW).

Wisconsin Univ., Madison.

For primary bibliographic entry see Field 06E.

W71-01550

WATER LAW IN SOUTHEASTERN WISCONSIN (WATERSHED MANAGEMENT AND POLLUTION CONTROL).

Wisconsin Univ., Madison.

For primary bibliographic entry see Field 06E.

W71-01551

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT OF THE COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 90th CONGRESS, 1st Session.

For primary bibliographic entry see Field 06E.

W71-01605

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 2ND Session.

For primary bibliographic entry see Field 06E.

W71-01634

HEARINGS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT--WATERSHED PROJECTS, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST Session.

For primary bibliographic entry see Field 06E.

W71-01635

05. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification of Pollutants

ECOLOGICAL STUDIES OF MARINE PLANKTON,

TRW Systems Group, Redondo Beach, Calif. Physical Research Center.

For primary bibliographic entry see Field 02L.

W71-01125

RADIOMETRIC DETECTION OF OIL SLICKS, Aerojet-General Corp., El Monte, Calif.

A. T. Edgerton, and D. T. Trexler.

Available from NTIS as AD-702 402, \$3.00 in paper copy, \$0.95 in microfiche. Report No SD 1335-1, Various pagings, January 1970. Contract DOT-CG-93,288A.

Identifiers: *Aerial reconnaissance, Water pollution, *Water, Pollution, *Radiometers, *Petroleum, Water, Detectors, Hydrocarbons, Fuel oil, Spectrum signatures, *Oil pollution, *Oil slicks, Microwave, Radiometry, *Remote sensing.

A study has been performed to assess the feasibility of using microwave radiometry for detection of oil pollution. The investigation stems from the U. S. Coast Guard's requirement for an airborne surveillance system which can detect oil pollution during inclement weather and during the hours of darkness. Laboratory and airborne measurements were made of a variety of oil base pollutants. Laboratory investigations included microwave response as a function of oil film thickness, physical temperature of the oil-water system, pollutant type sensor wavelength, antenna polarization, and observation angle. These studies consisted of dual-polarization radiometric measurements (observational wavelengths of 0.8cm and 2.2cm) of Bunker C fuel oil, gasoline, and 20, 30, and 40 API gravity crude oil. The dielectric properties of these pollutants were also measured by means of a 0.81 cm ellipsometer. The results of the laboratory measurements were used to select the most suitable microwave radiometer for the airborne measurements. The airborne measurements were of small oil slicks on the open ocean off the Southern California Coast. Measurements were made from an aircraft instrumented with a dual-polarized 0.81 cm radiometer oriented with a forward antenna viewing angle of 45 deg from nadir. Pollutants examined during the tests include marine diesel fuel; 20, 30, and 40 API gravity crude oils, and a mixture of diesel fuel and 20-gravity oil. Measurements were made under various atmospheric and low sea state conditions, including several at night.

W71-01144

NON-CHOLERA VIBRIOS OF EGYPTIAN SURFACE WATERS,

Naval Medical Research Unit No. 3, Cairo (Egypt).

For primary bibliographic entry see Field 05F.

W71-01161

ASSEMBLY AND EVALUATION OF AN IMPROVED PPB OXYGEN ANALYZER FOR SEAWATER,

Dow Chemical Co., Freeport, Tex.

For primary bibliographic entry see Field 03A.

W71-01201

DESIGN OF WATER QUALITY SURVEILLANCE SYSTEMS - PHASE I - SYSTEMS ANALYSIS FRAMEWORK,

NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.

Paul V. Morgan, Brownie R. Johnson, Henry C. Bramer, and Wallace L. Duncan.

Available from NTIS as PB-195 675, \$0.95 in microfiche. Also for sale by the Superintendent of Documents, U. S. Government Printing Office,

Washington, D.C. 20402. SOD I67.13/4: 16090DBJ 08/70. Water Pollution Control Research Series, 16090 DBJ 02/70. February 1970. 303 p, 5 tab, 14 fig, 2 append. FWQA Contract 14-12-476. FWQA Program 16090DBJ.

Descriptors: *Systems Analysis, *Water Quality, *Monitoring, *Legal Aspects, *Water Pollution, *Water Measurement, Water Quality Act, Water Quality Control, Water Quality Standards, Water Quality Criteria, Information Retrieval, Surveillance.

Identifiers: *Ohio River Basin, *Tennessee River Basin, Missouri River Basin, *Southeastern River Basins, *Systems Analysis Framework, Water Quality Monitors.

In order to accomplish the goals of the Water Quality Act of 1965, it is necessary to establish water quality surveillance systems throughout the nation. It is highly imperative that the individual systems developed by the various Federal, state, and interstate agencies be compatible and their data systems be interconnected. The various inputs and decisions necessary to accomplish this task are so complex that modern systems analysis techniques should be applied to insure that each of these water quality surveillance systems are developed and designed utilizing the same criteria. This study is the initial effort to apply systems analysis techniques to the solution of this problem. Three major river basins were selected for this study in order to identify the parameters common to any basin throughout the nation. The three basins were studied by: (1) reviewing the literature associated with their water quality characteristics; (2) on-site visits to the river basin areas; (3) comparative review of the interstate water quality standards and plans of implementation; and (4) legal considerations in surveillance program design. These tasks provided the input material to develop a systems analysis framework. The systems analysis framework was applied manually to select sites for water quality surveillance stations on the major streams studied within the three river basins.

W71-01264

BIOLOGICAL EFFECTS OF EFFLUENT FROM A DESALINATION PLANT AT KEY WEST, FLORIDA,

Westinghouse Ocean Research Lab., San Diego, Calif.

For primary bibliographic entry see Field 05C.

W71-01266

DISTRIBUTION OF ARSENIC IN UNCONSOLIDATED SEDIMENTS FROM SOUTHERN LAKE MICHIGAN,

Illinois State Geological Survey, Urbana.

R. R. Ruch, E. Joyce Kennedy, and Neil F. Shimp.

Study No 4 of Lake Michigan bottom sediments studies. Illinois Geological Survey Environmental Geology Note 37, September 1970. 16 p, 19 fig, 2 tab, 10 ref.

Descriptors: *Arsenic compounds, *Sediments, *Lake Michigan, Sediment-water interfaces, Cores, Distribution patterns, Radiochemical analysis, Gamma rays, Carbon, Organic matter, Alluvium, Clays, Michigan, Illinois.

Identifiers: Core samples, Grab samples, Waukegan (Ill), Benton Harbor (Mich).

This is the fourth in a series of reports covering investigations of the geology and chemical composition of Lake Michigan sediments. Major chemical objectives of these investigations are to assemble data on the distribution of trace elements in Lake Michigan sediments and to determine which geochemical processes operating during sedimentation affect the distribution of trace elements. Radiochemical separation procedures were used to determine the arsenic content of 89 core and grab samples from southern Lake Michigan. Arsenic was found to accumulate within the upper, or most recently deposited, portion of most of these sediments in concentrations ranging from about 5 to 30

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5A—Identification of Pollutants

ppm. Areas with high arsenic content were identified from sediment-water interface samples taken west of Benton Harbor, Michigan; east of Waukegan, Illinois; and southwest of Grand Haven, Michigan. Deposition of fine-grained sediments containing appreciable quantities of organic matter occurs at all these locations. Amounts of arsenic observed in the uppermost portions of these sediments generally vary directly with the organic carbon content and are probably a result of man's activities in the watershed surrounding the lake. (Woodard-USGS)
W71-01325

A GRAPHICAL SUMMARY OF DISSOLVED-OXYGEN DATA FOR THE DELAWARE RIVER ESTUARY FOR WATER YEARS 1965-69,
Geological Survey, Harrisburg, Pa.
Charles F. Merk.
Geological Survey Open-file report, September 1970. 15 p, 6 fig, 3 tab, 2 ref.

Descriptors: *Computer programs, *Dissolved oxygen, *Delaware River Basin Commission, Water quality control, Statistical methods, Temperature, Data collections, Data processing, Estuarine environment.
Identifiers: *Computer techniques, Graphical summaries, Stream-quality objectives.

To provide the user of the Delaware River estuary with concise information on the DO condition during the 5-year period for comparison with recently adopted Delaware River Basin Commission stream-quality objectives, data from 5 water-quality monitors are summarized and graphed by a computer process. The computer technique is developed to show the daily DO conditions statistically, including maximum, mean, and minimum values. Graphical summaries define the 5-year range of DO data for each of the 122 3-day periods of the water year. Monitor locations and zones sampled are shown on a sketch map and tables give DO objectives by river zones and DO daily statistics at Bristol, Penn. Computer processing provides convenient handling of the large quantity of data used to prepare the graphical summaries. (Lang-USGS)
W71-01327

A CONTINUOUS MONITOR FOR HEX-AVALENT CHROMIUM IN RIVER WATER,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
For primary bibliographic entry see Field 05B.
W71-01515

WALKER BRANCH WATERSHED PROJECT PROPORTIONAL WATER SAMPLER DESIGN REPORT AND OPERATING MANUAL,
Oak Ridge National Lab, Tenn.
W. F. Johnson, and W. R. Miller.
Available from NTIS as ORNL-TM-2839, \$3.00 in paper copy, \$0.95 in microfiche. ORNL-TM-2839, 10 Feb 70. 21 p, 5 fig.
Identifiers: *Rivers, Samplers, Water, Flowmeters, Design, Calibration, *Water samplers.

An automatic sampler was designed and constructed to withdraw samples of water from flowing outdoor streams. The volume of sample withdrawn is automatically in volumetric proportion to the stream flow rate. These samples are collected and combined as a large composite sample for laboratory analysis. The frequency of sampling can be adjusted manually. The sampler system will also automatically switch to a fast sampling mode such as during a storm whenever the rate of increase of the stream flow rate exceeds a preset value. In this mode the system collects individual samples in volumetric proportion to the stream flow rate in up to 250 bottles, each 250 ml capacity, at a rate of up to four individual samples per minute. These samples are not combined.
W71-01522

5B. Sources of Pollution

MEDDOCK V NATIONAL TRANSIT CO (LIABILITY FOR POLLUTION OF SPRING BY LEAKAGE OF OIL FROM PIPELINE).
For primary bibliographic entry see Field 06E.
W71-01115

EVALUATION OF THE HAZARD OF BULK WATER TRANSPORTATION OF INDUSTRIAL CHEMICALS: A TENTATIVE GUIDE.
National Academy of Sciences-National Research Council, Washington, D.C.

Available from NTIS as PB-189 845, \$3.00 in paper copy, \$0.95 in microfiche. 1969. 25 p. Revised edition.
Identifiers: *Chemicals, *Shipping (Marine), *Hazards, Chemicals, *Water pollution, Shipping (Marine), *Toxicity, *Fire safety, Shipping (Marine), Flammability, Standards, Irritating agents, Poisons, Aquatic animals, Amines, Aromatic compounds, Halogenated hydrocarbons, Acetates, Ketones, Formaldehyde, Gases, Oils, Petroleum, Metalorganic compounds, Organic solvents, Fuels, Epichlorohydrin, Tetraethyl lead, Hydrofluoric acid, Acrylates, *Oil pollution, *Water transportation, *Hazardous materials.

The fire hazards, health hazards, water pollution, and reactivity of some 209 industrial chemicals are presented. The ratings put forth in the report represent the over-all potential hazard connected with the bulk water shipment of specified industrial chemicals. The ratings were prepared specifically to select to the Coast Guard the hazards or absence of hazards in shipping chemicals in their present industrial grades in bulk by water. They are not intended to be used for any other purpose and they are not considered valid to estimate the degree of hazard of handling these chemicals in any other manner.
W71-01135

RADIOACTIVITY IN WATER: PROJECT RULISON,
Teledyne Isotopes, Palo Alto, Calif.
For primary bibliographic entry see Field 05G.
W71-01136

CONTAINMENT OF OIL SPILLS BY PHYSICAL AND AIR BARRIERS,
Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
For primary bibliographic entry see Field 05G.
W71-01141

MERIWETHER SAND AND GRAVEL CO V STATE (POLLUTION OF STREAMS).
For primary bibliographic entry see Field 06E.
W71-01147

COMMONWEALTH V CITY OF NEWPORT NEWS (LEGISLATIVE POWER TO AUTHORIZE DISCHARGE OF SEWAGE).
For primary bibliographic entry see Field 06E.
W71-01165

ANALYSIS AND MODEL TESTS TO DETERMINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM,
Hydronautics Inc., Laurel, Md.
For primary bibliographic entry see Field 05G.
W71-01172

LITTLE V MARTIN FURNITURE CO (LIABILITY FOR CONTRIBUTING TO THE POLLUTION OF A STREAM).
For primary bibliographic entry see Field 06E.
W71-01182

RELATIONSHIPS BETWEEN PESTICIDAL APPLICATION AND WATER CONTAMINATION UNDER IRRIGATION IN THE GREAT PLAINS,
Kansas Water Resources Research Inst., Manhattan.

Herbert Knutson, A. M. Kadoun, T. L. Hopkins, T. L. Harvey, and G. F. Swayer.
Available from NTIS as PB-195 670, \$3.00 in paper copy, \$0.95 in microfiche. Kansas Water Resources Research Institute Contribution No 45, August 1970. 18 p, 2 tab, 1 fig, 11 ref. OWRR Project B-007-KAN (1).

Descriptors: *Insecticides, *Irrigation, *Carbamate pesticides, *Organophosphorus pesticides, Aldrin, Dieldrin, Endrin, Heptachlor, Wells.
Identifiers: Residues, Smoky Hill River, Cedar Bluff Reservoir, Corn.

Soil and foliar applications of insecticides were made annually (1965-1969) at approximate maximum recommended rates to a 20-acre, irrigated corn field receiving 30 to 42 inches of moisture per year. In 1967, two additional benches were added, which received twice the normal amount of irrigation water and 10 to 20 times the amount of insecticides. Capped wells, from 6.5 to 71 feet deep, located on the berms between the benches, contained no residues at the 0.1 ppb level, indicating no vertical penetration from surface applications (penetration did not exceed 12 inches) and no lateral contamination of groundwater from adjacent land. Surveys of insecticide use, 1960-1969, indicated generally light application of insecticides throughout the District before irrigation started in 1963. The use of organophosphates and carbamates greatly increased, followed by decreased use of organochlorines. Surface water samples from the Smoky Hill River and the Cedar Bluff Reservoir also contained no residues at the 0.1 ppb level. Aldrin, dieldrin, endrin, heptachlor, heptachlor epoxide, and DDE were infrequently indicated in surface waters at trace (ppt) levels. Detection of little or insignificant contamination of surface waters agrees with survey results indicating little use of organochlorine insecticides in the District. The results indicate that insecticides at recommended maximum rates for 5 year on a 20-acre field, and use on adjacent dry land and in the newly developed irrigation district, did not contaminate groundwater. (McKenna-Kansas State University)
W71-01195

LEACHATE MOVEMENT IN THE SUB-SOIL BENEATH A SANITARY LANDFILL TRENCH TRACED BY MEANS OF SUCTION LYSIMETERS,
Pennsylvania State Univ., University Park. Dept. of Geology and Geophysics.
Burke E. Lane, and Richard R. Parizek.
Proceedings of the 2nd Mid-Atlantic Industrial Waste Conference, November 18-20, 1968, Drexel Institute of Technology, p 261-277, 1968. 17 p, 11 fig, 1 ref.

Descriptors: *Path of pollutants, *Leaching, *Landfills, *Garbage dumps, *Groundwater movement, Karst, Infiltration, Ion transport, Pennsylvania, Subsurface drainage, Water quality, Water pollution sources, Lysimeters.
Identifiers: State College (Penn), Sanitary Landfill drainage.

The landfill site lies about 2 miles northwest of State College. The landfilling operation is on steep hillsides. The tops of the valley walls are about 100 feet high and the slopes approach 40 degrees near the valley bottom. The valley bottom is a dry, underdrained karst stream bed. Groundwater exists under water table conditions at a depth of about 250 feet. The water quality monitoring system consisted of a 900 square-foot sheet of plastic to line the bottom of a landfill trench, a spreader pipe in an infiltration trench, and a protective housing. The soil water sampling devices consisted of 17 suction lysimeters installed at various depths in the soil beneath the landfill trench. Movement of a wave front of leachate-polluted soil water could be traced in the soil beneath the landfill trench. Severe

pollution of the soil water in the immediate vicinity of a landfill can result even though the landfill is not in direct contact with a water table and even before the refuse has become saturated to field capacity. (Knapp-USGS)
W71-01204

FURTHER CONSIDERATIONS ON INLAND SEWAGE DISPOSAL IN FALMOUTH, MASSACHUSETTS,
Geological Survey, Woods Hole, Mass.
For primary bibliographic entry see Field 05E.
W71-01205

SIMULATION OF A RIVER THERMAL BEHAVIOR FROM DATA OBTAINED BY A CLASSICAL METEOROLOGICAL NETWORK (FRENCH),
Electricite de France, Chatou.
For primary bibliographic entry see Field 02A.
W71-01221

MONROE CARP POND CO V RIVER RAISIN PAPER CO (RIPARIAN PROPRIETOR'S RIGHT TO USE STREAM NOT ABSOLUTE).
For primary bibliographic entry see Field 06E.
W71-01231

OHIO STOCK FOOD CO V GINTLING (STREAM POLLUTION BY UPPER RIPARIAN HOG FARM).
For primary bibliographic entry see Field 06E.
W71-01237

MANHATTAN OIL CO V MOSBY (LIABILITY FOR POLLUTING STREAM BY ESCAPE OF SALT WATER FROM OIL WELL).
For primary bibliographic entry see Field 06E.
W71-01303

CONSIDERATIONS ON INLAND SEWAGE DISPOSAL IN FALMOUTH, MASSACHUSETTS,
Woods Hole Oceanographic Institution, Mass.
For primary bibliographic entry see Field 05E.
W71-01324

DISTRIBUTION OF ARSENIC IN UNCONSOLIDATED SEDIMENTS FROM SOUTHERN LAKE MICHIGAN,
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 05A.
W71-01325

FLOW GRAPH MODELS OF THERMAL PROCESSES,
Windsor Univ. (Ontario).
For primary bibliographic entry see Field 07B.
W71-01343

THE EFFECT OF LAND UTILIZATION ON WATER QUALITY VARIATIONS,
Rutgers - The State Univ., New Brunswick, N.J.
Dept. of Environmental Sciences.
Richard P. Tokarski.
New Jersey Water Resources Research Institute, Rutgers University, New Brunswick, New Jersey, Oct. 1970, 64 p., 7 tab, 19 fig, 20 ref, 2 append.
FWPCA Grant WP-143.

Descriptors: *Water pollution, *Water analysis, *Land use, Water quality, Biochemical oxygen demand, Nitrates, Phosphates.

This is a study of the occurrence of pollution on Puff Brook, a small watershed in New Jersey which includes a comparison of the pollution effects from a variety of land uses. High dissolved oxygen levels resulting from large numbers of algae were found in a pond; a maintenance yard area contributed oil, grease and washings from farm equipment; a

pasture was found to contribute fecal matter to the stream. Contrary to expectations, a housing development did not exert a significant effect on water quality except during periods of runoff, and even then less than agricultural contributions. A further study was made to compare water quality data from this stream to that of tertiary waste treatment effluents, and the latter were found to be inferior, particularly as regards phosphates. (Whipple-Rutgers)
W71-01345

JOHNSON V CITY OF FAIRMONT (JOINT LIABILITY OF INDEPENDENT POLLUTERS).
For primary bibliographic entry see Field 06E.
W71-01414

CITY OF CINCINNATI V KIRK (CITY'S LIABILITY FOR POLLUTION FROM SEWAGE SYSTEM).
For primary bibliographic entry see Field 06E.
W71-01415

TICHENOR V WITHERSPOON (LIABILITY FOR DISCHARGE OF POLLUTANTS INTO STREAM).
For primary bibliographic entry see Field 06E.
W71-01416

OAKWOOD SMOKELESS COAL CORP V MEADOWS (LIABILITY FOR DAMAGE RESULTING FROM NORMAL OPERATION OF COAL MINE).
For primary bibliographic entry see Field 06E.
W71-01432

HAMPTON V TOWN OF SPINDALE (DISCHARGE OF INDUSTRIAL WASTES INTO MUNICIPAL SEWER SYSTEM).
For primary bibliographic entry see Field 06E.
W71-01437

THE SS NEA HELLIS (FINES FOR DISCHARGING OIL INTO NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-01450

UNITED STATES V THE DELVALLE (UNINTENTIONAL WATER POLLUTION BY UNUSED FUEL OIL).
For primary bibliographic entry see Field 06E.
W71-01454

DOHANY V CITY OF BIRMINGHAM (DUTY OF CITY TO PROPERLY MAINTAIN SEWAGE DISPOSAL PLANT).
For primary bibliographic entry see Field 06E.
W71-01467

'APPARENT' ORGANOCHLORINE INSECTICIDE CONTENTS OF SOILS SAMPLED IN 1910,
Wisconsin Univ., Madison. Dept. of Soil Science.
B. E. Frazier, G. Chesters, and G. B. Lee.
Pesticides Monitoring Journal, Vol 4, No 2, p 67-70, 1970. 3 fig, 2 tab, 5 ref. OWRR B-016-WISC (9).

Descriptors: *Insecticides, *Soils, Degradation, Chromatography, Analysis, Aldrin, Heptachlor, Soil properties.
Identifiers: *Organochlorine insecticides, Heptachlor epoxide.

Archives of the Wisconsin University's (Madison) Department of Soil Science include many soil samples collected by soil surveyors between 1909 and 1911. These samples were stored in tightly sealed containers. Thirty-four of these samples were extracted with Skelly B:acetone azeotropic solution

and analyzed by gas chromatography on 3 columns. The results of analyses have indicated the apparent presence of organochlorine insecticide residues which originated from indigenous soil constituents. Peaks corresponding to heptachlor epoxide on QF-1/OV-17 and to aldrin on QF-1/DC-200 columns caused major interference with chromatographic determinations. (Wilde-Wisconsin)
W71-01478

DISTRIBUTION OF MERCURY IN NATURAL WATERS OF THE SOUTHERN SLOPE OF NORTHWESTERN CAUCASUS (IN RUSSIAN),
Severo-Kavkazskogo Geologicheskogo Upravleniya, Laurskaya Gidrogeologicheskaya Psartiya.
V. G. Baev.
Doklady Akademii nauk SSSR, Vol 181, No 5, p 1249-1251, 1968. 1 fig, 1 tab, 8 ref.

Descriptors: *Inorganic compounds, *Metals, Streams, Groundwater, Analysis, Statistical methods, Water pollution sources, Water properties, Geologic formations.
Identifiers: *Mercury, Dithizone method, Mercury deposits, Cretaceous formations, Jurassic formations, Northwestern Caucasus.

The content of mercury was determined in more than 7000 samples of stream and groundwaters in 1100 square kilometer area of the northwestern Caucasus. The determinations of mercury were performed directly in the field by the use of dithizone method. The results obtained for separate watersheds were subjected to statistical analyses. Concentrations of mercury ranged from 3 to 10 ppb. Investigations established several relationships in the distribution of mercury and revealed several new deposits of the metal. Mercury in the surface or subterranean waters is not necessarily an industrial pollutant. (Wilde-Wisconsin)
W71-01481

A CONTINUOUS MONITOR FOR HEX-AVALENT CHROMIUM IN RIVER WATER,
Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
D. W. Alton.
Available from NTIS as BNWL-1168, \$3.00 in paper copy, \$0.95 in microfiche. October 1969, 49 p. AEC Research and Development Report BNWL-1168.
Identifiers: *Water pollution, *Chromium compounds, *Wastes industrial, *Chromium, *Colorimetric analysis, Chromium, Chromates, Monitors, Corrosion inhibition, Nuclear reactors.

A continuous monitor for hexavalent chromium was developed and placed in routine operation at the Automatic Columbia River Monitor Station (ACRMS), located at the 300 Area of Hanford, approximately 4 miles upstream from the nearest public water supply intake. Basically, the unit is commercially available equipment which uses a colorimetric method for continuous determination of Cr (plus 6) concentrations in river water. With a modified water filtration system and other changes, Cr (plus 6) in river water as low as 2 to 3 parts per billion can be measured reliably. A remote alarm system preset to actuate at a Cr (plus 6) concentration of 25 ppb, provides the necessary time interval to enable water plants downstream to discontinue intake.
W71-01515

MICROBIAL CONTAMINATION IN SPACECRAFT WATER SYSTEM.
Aircraft Porous Media, Inc., Glen Cove, N.Y.

Available from NTIS as N70-23897, \$3.00 in paper copy, \$0.95 in microfiche. Final Report for NASA Manned Spacecraft Center, Doc No H-1360-2, Mar 1970. NASA Contract NAS 9-9027.

Descriptors: Pollutants, Bacteria, Recirculated water.

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Group 5B—Sources of Pollution

Identifiers: *Pseudomonas diminuta*.

A study was conducted to determine the degree of microbial back contamination to be expected from the waste water to the potable water in the Apollo Command Module water system. The study shows that a bacteria removal filter is needed immediately upstream of the potable water tank or immediately upstream of the potable water outlet.
W71-01516

ORGANIC MATERIALS IN THE MARINE ENVIRONMENTS AND THEIR INTERACTIONS WITH SOME METAL IONS,

Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
Elizabeth Koshy, and A. K. Ganguly.
Available from NTIS as BARC-402, \$3.00 in paper copy, \$0.95 in microfiche. Government of India, Atomic Energy Commission Report, BARC-402, 1969. 128 p, 60 ref.

Identifiers: *Amino acids, *Dissolving, *Organometallic compounds, *Sea water, *Trace elements, Metal ions, Sediments, Solubility, Barium, Iron, Niobium, Zirconium, Humic acid, Zinc, Manganese.

The processing of formation of dissolved organic matter, separation and identification of the amino acids, interaction of the dissolved organic matter with trace elements, and characterization of the sediment humus and its role in solubilization and pick up of trace elements in the sea were investigated. Methods used for concentrating dissolved organic substances from sea water were evaluated. The methods of concentration of dissolved organic matter from a C-14 laboratory culture raised in sea water medium and from natural sea water are described. The amino acids constituents from these concentrates are identified and compared with those in the hydrolysates of a marine sediment humic acid. The interaction of trace elements such as Mn, Zn, Ba, Fe, and Zr-Nb (radioactive tracers) with the dissolved organics present in the culture solution was studied. Preparation, purification, and characterization of humic acid separated from the coastal sea bed sediment are described in detail. The trace metallic element contents in a highly purified humic acid are investigated.
W71-01523

VARIATION OF URBAN RUNOFF WITH DURATION AND INTENSITY OF STORMS,

Texas Tech Univ., Lubbock. Water Resources Center.
Robert C. Brownlee, T. Al Austin, and Dan M. Wells.

Available from NTIS as PB-195 785, \$3.00 in paper copy, \$0.95 in microfiche. Texas Tech University Water Resources Center Interim Report No WRC-70-3, September 1970. 68 p, 12 fig, 30 tab, 10 ref. OWRR Project No B-064-TEX (1).

Descriptors: *Storm runoff, *Water pollution sources, Cities, Urbanization, Sewage treatment, Sewage disposal, Biochemical oxygen demand, Statistics, Data collections, Hydrologic data, Rainfall-runoff relationships.

Identifiers: Urban runoff, Combined sewers.

A great many cities transport raw domestic sewage to treatment facilities in the same sewer systems used to carry storm runoff from their streets. The storm runoff carried by these combined sewers, during even moderate rainstorms, can greatly exceed the capacity of municipal sewage treatment plants. This study was undertaken to determine the concentrations of pollutants carried by the storm runoff from a small residential watershed, and to consider the variations of pollutant concentrations with the duration of runoff. Surface runoff from rainstorms on the small residential watershed contains pollutant concentrations which vary in average and extreme values from storm to storm. Average total dissolved solids and nitrates as well as the average pH value of storm runoff are within the USPHS standards for drinking water, while

solids concentrations and total alkalinity concentrations are in the range of those found in raw sewage influent. Average BOD concentration of the samples tested is approximately the same as that of secondary sewage treatment effluent. Regression and correlation analyses indicate a definite reduction in constituent concentrations with duration of runoff. Rainfall intensities, antecedent moisture conditions, storm movements, and other parameters also influence this relationship. (Knapp-USGS)
W71-01546

POLLUTION ABATEMENT FACILITIES—GRANTS AND LOANS FOR PRELIMINARY PLANNING.

For primary bibliographic entry see Field 06E.
W71-01553

LET THE POLLUTER BEWARE (LEGAL RAMIFICATIONS OF POLLUTION),

For primary bibliographic entry see Field 06E.
W71-01562

AIR AND WATER POLLUTION,

For primary bibliographic entry see Field 06E.
W71-01565

REGULATION OF POLLUTION BY MINE WASTES.

For primary bibliographic entry see Field 06E.
W71-01570

WHAT CONSTITUTES A VIOLATION OF THE PROHIBITION, IN THE OIL POLLUTION ACT OF 1924 (33 USC 431 ET SEQ), OF DISCHARGE OF OIL INTO NAVIGABLE WATERS AND ADJOINING SHORELINES,
For primary bibliographic entry see Field 06E.
W71-01575

SQUAW ISLAND FREIGHT TERMINAL CO V CITY OF BUFFALO (RECOVERY OF DAMAGES FOR CITY'S POLLUTION OF RIVER).

For primary bibliographic entry see Field 06E.
W71-01580

G L WEBSTER CO V STEELMAN (ABATEMENT OF STREAM POLLUTION CAUSED BY CANNERY).

For primary bibliographic entry see Field 06E.
W71-01582

UNITED STATES V CARROLL OIL TERMINALS, INC (ACCIDENTAL OIL LEAKAGE CAUSED BY STORM DAMAGE).

For primary bibliographic entry see Field 06E.
W71-01595

THE WATUPPA (VESSEL LIABLE FOR DUMPING WASTE OUTSIDE AUTHORIZED AREA).

For primary bibliographic entry see Field 06E.
W71-01596

COMMONWEALTH V PHILADELPHIA AND READING IRON AND COAL CO (POLLUTION OF WATER SUPPLIES AS PUBLIC NUISANCE).

For primary bibliographic entry see Field 06E.
W71-01599

PUBLIC SERV COMM'N V SINKING SPRING WATER CO (REQUIRING POTABLE WATER FROM SUPPLIER).

For primary bibliographic entry see Field 06E.
W71-01602

SQUAW ISLAND FREIGHT TERMINAL CO V CITY OF BUFFALO (RIPARIAN RIGHTS AND WATER QUALITY).

For primary bibliographic entry see Field 06E.
W71-01623

DU PONT RAYON CO V RICHMOND INDUSTRIES, INC (RIPARIAN RIGHT TO USE WATER VERSUS PUBLIC RIGHT TO USE STREAM FOR SEWAGE).

For primary bibliographic entry see Field 06E.
W71-01631

ECKART V CITY OF BELLEVILLE (CITY'S LIABILITY FOR WATER POLLUTION CAUSED BY DISCHARGE OF RAW SEWAGE INTO STREAM).

For primary bibliographic entry see Field 06E.
W71-01637

NEWKIRK V CITY OF TIPTON (SUIT FOR DAMAGES FOR REDUCTION IN LAND VALUE BECAUSE OF POLLUTION OF A STREAM).

For primary bibliographic entry see Field 06E.
W71-01640

THE ALBANIA (LIABILITY FOR DISCHARGE OF OIL IN HARBOR BY SHIP).

For primary bibliographic entry see Field 06E.
W71-01643

5C. Effects of Pollution

ORGANIZATION AND DISTRIBUTION OF PHOTOPANKTON COMMUNITIES,

Instituto de Investigaciones Pesqueras, Barcelona (Spain).
For primary bibliographic entry see Field 02L.
W71-01132

EXPERIMENTAL APPLICATION OF CHLOROPHOS FOR MOLLUSC CONTROL AT POND FARMS,

Bureau of Commercial Fisheries, Washington, D.C. Office of Foreign Fisheries (Translations).
For primary bibliographic entry see Field 05G.
W71-01140

BIOLOGICAL EFFECTS OF EFFLUENT FROM A DESALINATION PLANT AT KEY WEST, FLORIDA,

Westinghouse Ocean Research Lab., San Diego, Calif.
W. D. Clarke, J. W. Joy, and R. J. Rosenthal.
Available from NTIS as PB-195 677, \$0.95 in microfiche. Also for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. Price \$1.00 per copy. SOD I67.13/4: 18050DAI 02/70. Water Pollution Control Research Series, 18050 DAI 02/70, February 1970. 94 p, 13 tab, 29 fig, 12 ref, 5 append. FWQA Project 18050 DAI, Contract 14-12-470.

Descriptors: *Effluents, *Aquatic environment, *Biological communities, *Environmental effects, *Desalination plants, Water pollution effects, Desalination, Florida, Ecology, Environment, Descaling, Biota, Physiological ecology, Thermal pollution, Heated water, Biological properties, Physicochemical properties, Discharge measurement, Plankton.

Identifiers: *Ecological effects, Key West (Fla), Desalting plant effluent.

The Key West study was undertaken to determine the impact of the discharge from a large desalting plant on the surrounding environment. The Phase-I work has shown that some of the properties of the effluent can be detected by physical and chemical measurements well beyond the area that visible ef-

fects can be detected in the bottom communities. While the effluent produces some beneficial effects such as attracting certain species of fish and the stone crab, *Minippe mercenaria*, it has also been shown to have deleterious effects for other organisms. Algae, tunicates, and gastropods were excluded from the near-field of the effluent discharge and bryozoan colonies were not as numerous in the discharge area nor did they grow as well as they did outside of the area. Quantitative investigations of the physiological and ecological effects of the desalting plant effluent in future studies could lead to predictive capabilities as far as the amount of environmental stress that can be tolerated at a given locality. The Key West municipal government is considering locating a power plant and additional desalination facilities at the Safe Harbor site. The additional discharges can be used to test the predictive models developed during the Phase-II study. For the Phase-II study, it is recommended that the main emphasis of the study be to investigate biological alterations resulting from the effluent of the desalting plant and to develop quantitative criteria for predicting and assessing the impact of a heated, hypersaline effluent on the biota of the receiving waters. Probably even more important to the Phase-II study is determining the effects of desalting operations on the environment and biota. All of the physical data for Phase-I work have been placed on magnetic tape and punched cards. It is recommended that these data be analyzed more completely.

W71-01266

MERCURY IN FRESHWATER FISH,

Fisheries Research Board of Canada, Winnipeg (Manitoba).
E. G. Bligh.
Fisheries of Canada, Vol 22, No. 10, p 7-8. May-June, 1970.

Descriptors: *Heavy metals, Public Health, Water pollution sources, Water pollution effects, *Pulp wastes, Pulp and paper industry, Monitoring, Toxicity, Industrial wastes.
Identifiers: *Mercury, Sweden, Japan, *Minamata disease, *Slimicides.

The mercury pollution problem throughout the world is discussed. Deaths in Japan and exceedingly high levels of mercury in fish in Sweden are documented. The accumulation of mercury in fish muscle is rapid but elimination is slow. Thus, in fish, highest concentrations are found in larger or older fish. The author discusses the monitoring program being carried out by the Fish Inspection group of the Canadian Fisheries Research Board to determine mercury content of marine and freshwater fish. If toxic levels are reached, the fish in the catch are destroyed. (Katz - Washington)

W71-01267

MERCURY POLLUTION,

Fisheries Research Board of Canada, Winnipeg (Manitoba). Freshwater Inst.
E. H. Hearnden.
Fisheries of Canada, Vol 22, No 10, p 3-6, 1970.

Descriptors: *Public health, *Heavy metals, Water pollution effects, Monitoring, *Inspecting, Water pollution sources, Industrial wastes, Great Lakes.
Identifiers: *Mercury, Saskatchewan River, Fishing closures.

In November, 1969, a report made by the Saskatchewan government disclosed that abnormal levels of mercury had been detected in fish from the Saskatchewan River. The fish from the river were immediately taken into custody and those lots with over 0.5 ppm of mercury were destroyed. One million pounds were incinerated. The mercury was traced to a chlor-alkali plant. With 14 of these plants operating across Canada an intensive monitoring program was undertaken. Some additional areas were closed to fishing because of mercury pollution. Steps have been taken to control and eliminate the mercury pollution problem in Canada. (Katz-Washington)

W71-01268

CHLORINATED HYDROCARBONS IN THE YOUNG OF LAKE MICHIGAN COHO SALMON,

Bureau of Sport Fisheries and Wildlife, LaCrosse, Wis.
Wayne A. Willford, Joe B. Sills, and Everett W. Whealdon.
The Progressive Fish-Culturist, Vol. 31, No. 4, p 220, October 1969.

Descriptors: *Chlorinated hydrocarbons, *Salmon, *DDT, Mortality, *Great Lakes, Lake Michigan, Fish eggs, Fry, Oregon.
Identifiers: *Dieldrin, *Coho.

Analysis of dead and drying sack fry from Lake Michigan revealed 3.4 ppm of DDT and related compounds plus 0.07 ppm of dieldrin, based on whole body weight. Fish that survive hatching are not exposed to contaminated water or feed excrete very little of these compounds. They dilute them by growth. Lake Michigan eggs had 30% mortality compared with Oregon coho (4%) which contained 0.18 ppm of DDT and related compounds and no detectable dieldrin. (Wahtola-Washington)

W71-01270

KINETICS OF ONSET OF RESPONSES BY SHARKS TO WATERBORNE DRUGS,

Mote Marine Lab., Sarasota, Fla.
H. David Baldrige, Jr.
Bulletin of Marine Science, Vol. 19, No. 4, p 880-896 December 1969, 10 ref. 1 tab. 5 fig.

Descriptors: *Kinetics, *Behavioral indicators, *Sharks, *Waterborne drugs, Oxygen requirements, Temperatures, Hydrogen Ion - concentration, Mathematical studies, Repellent.
Identifiers: *Lemon sharks, *MS-222, *Quinaldine, *Strychnine Nitrate, *Sodium cyanide.

Substances tested were MS222, Quinaldine, strychnine and sodium cyanide. The occurrence along a time scale of behavioral indicators of responses elicited from young sharks by waterborne drugs was treated mathematically as a result of competitive kinetic processes, in order to demonstrate applicability of classical rate theory to the study of chemical shark deterrents. First-order rates constants were calculated for the overall ability of lemon sharks to counter effects of several incapacitating drugs. Limited studies were conducted on the rate of oxygen utilization by young, free-swimming lemon sharks. (Wahtola-Washington)

W71-01271

POPULATIONS OF TROUT AND GRAYLING IN TWO SCOTTISH RIVERS,

Clyde River Purification Board, East Kilbride (Scotland).
David W. Mackay.
Journal of Fish Biology, Vol 2, p. 39-45, 1970, 4 tab, 2 fig, 9 ref.

Descriptors: *Water pollution effects, *Fish populations, Brown trout, *Growth rates, Fish management, Fish harvest, Benthic fauna, Fishkill, On-site data collections, *On-site investigations, Sport fishing, Streamflow.
Identifiers: *Grayling, Scotland, River Gryfe, Douglas Water River, Length-weight ration, Ephemeroptera, Plecoptera.

Major pollutions resulted in the deaths of all fish in 8 km long stretches of two trout streams in central Scotland. Fish were collected, measured and weighed and the ages established by scale-reading. The predominant species present were brown trout, *Salmo trutta* (L), and grayling *Thymallus thymallus* (L) with about five times as many trout as there were grayling in each stream. The Douglas Water, which was previously unpolluted, held five times as many fish as the River Gryfe which had a history of intermittent pollution. The trout and grayling of the River Gryfe grew faster than those

from the Douglas Water and there were more of the large sizes present. (Katz-Washington)

W71-01272

ACUTE TOXICITY TO FISH OF SOLUTIONS CONTAINING COMPLEX METAL CYANIDES, IN RELATION TO CONCENTRATIONS OF MOLECULAR HYDROCYANIC ACID,

Oregon State Univ., Corvallis. Fisheries Research Labs.
Peter Doudoroff, Gerard Luduc, and Carl R. Schneider.
Transactions to the American Fisheries Society, Vol 95, No 1, p 6-22, Jan. 1966. 3 tab., 1 fig, 26 ref.
US Public Health Service Grant WP-162.

Descriptors: Sunfishes, *Toxicity, Bioassay, Water pollution effects, Hydrogen ion concentration, Industrial wastes, Mode of action, *Lethal limit, Carbon dioxide, Heavy metals, Gas chromatography, Analytical techniques, Evaluation.
Identifiers: *Metal cyanides, *Hydrocyanic Acid, *Cyanide ion, Nickelocyanide complex, Sodium cyanide, Silver cyanide.

Published indirect evidence indicating that the toxicity of solutions of complex metal cyanides to fish is a function of the concentration of molecular HCN is reviewed. The striking influence of pH on the toxicity of the nickelocyanide complex could be explained only by assuming that HCN is the toxic factor. By means of gas liquid chromatography, it was possible to demonstrate conclusively that this factor virtually alone determined the acute toxicity to bluegills of various solutions of simple and complex cyanides. Median immobilization times for bluegills in the solutions varied independently of total cyanide concentrations but were clearly related to molecular HCN levels. Two of three tested solutions containing the silver-cyanide complex proved exceptional; their toxicity produced symptoms strongly suggestive of heavy-metal poisoning and was deemed referable to toxicity of the complex anions or of silver cations. The presence of representative water pollutants tested did not impair the precision and accuracy of the HCN determinations. Changes in CO₂ content and pH of the medium occurring at gill surfaces had no appreciable influence on the toxicity of the nickelocyanide complex, presumably because dissociation is not very rapid. Thus, the analytical method used for determination of HCN was shown to be useful in waste disposal control. (Katz-Washington)

W71-01273

ECOLOGY OF JUVENILE TARPON AND EFFECTS OF DIELDRIN ON TWO ASSOCIATED SPECIES,

Federal Water Pollution Control Administration, Washington, D.C.
Richard Archer Wade.
Bureau of Sport Fisheries and Wildlife, Technical Paper No. 41. 1969. 85 p, 6 tab, 28 figs, 53 ref.

Descriptors: *Chlorinated hydrocarbons, *Dieldrin, *Bioassay, Toxicity, Lethal limits, Salinity, Temperature, Hydrogen ion concentration, Distribution, Laboratory equipment, Regulated flow, Persistence, Freshwater, Estuarine environment, Laboratory equipment.
Identifiers: *Tarpon, *Sheepshead minnow, Sailfin molly, Symptoms, TLM, *Interactions, Literature review.

The chlorinated hydrocarbon compounds are ranked according to their relative toxicities to several species of fish. The distribution, persistence, and effects of dieldrin in freshwater and estuarine areas are presented. A constant-flow apparatus was constructed for bioassay testing. Methods of collection, treatment, and acclimation of *Cyprinodon variegatus* and *Doecilia latipinna* are described. Symptoms of dieldrin poisoning are described. The means and variances of 76, 48-hour TL bioassays for the effects of dieldrin at three temperatures, three salinities, and two hydrogen

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ion concentrations are presented. No toxicity experiments were conducted using tarpon as a test fish. (Wahtola-Washington)
W71-01274

JUGLONE (5-HYDROXY-1,4-NAPHTHOQUINONE) AS A FISH TOXICANT.
Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.
Leif L. Marking.
Transactions of the American Fisheries Society, Vol. 99, No. 3, p 510-514, July 1970. 4 tab, 24 ref.

Descriptors: *Fish toxicant, *Biologically active, Bioassay, Toxicity, Fish, Temperature, Hydrogen ion concentration.
Identifiers: *Juglone, *Walnut trees, *LC50, Rainbow trout, Northern pike, Goldfish, Carp, White suckers, Black bullheads, Channel catfish, Green sunfish bluegills.

A new type of fish toxicant is described. Juglone, a biologically active chemical occurring in various parts of walnut trees, was tested for its toxicity to fish. The 96-hour LC50 values obtained from static bioassays at 12°C range from 27 to 88 parts per billion for rainbow trout, northern pike, goldfish, carp, white suckers, black bullheads, channel catfish, green sunfish and bluegills. The toxicity of juglone to rainbow trout and bluegills was not altered significantly in waters of different temperature or hardness. Standard (pH=7.4) and buffered (pH=9.0) solutions of juglone aged for one week effectively killed rainbow trout although approximately three times as much juglone was required at the high pH. According to other investigators, juglone is easily reduced to less toxic components by factors in the natural environment. However, juglone is sufficiently persistent to eliminate target fish prior to its degradation. (Wahtola-Washington)
W71-01275

SOME ACUTE AND CHRONIC EFFECTS OF DIELDRIN ON THE SAILFIN MOLLY, POECILIA LATIPINNA.
Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
Charles E. Lane, and Robert J. Livingston.
Transactions of the American Fisheries Society, Vol. 99, No. 3, p. 489-495, July 1970. 2 tab, 4 fig, 20 ref.

Descriptors: *Water Pollution Effects, *Dieldrin, *Pesticides, Chlorinated hydrocarbons, Laboratory equipment, Bioassay, Toxicity, Temperature, Salinity, Tissue concentrations, *Sailfin Molly.
Identifiers: *Poecilia latipinna, Gills, Muscle, Intestine, Brain, Liver, Blood.

Acute and Chronic Effects of Dieldrin on sailfin molly were described. More than half of the experimental fishes survived 0.0015 and 0.00075 ppm of pesticide for 34 weeks. However, 0.012 ppm dieldrin killed all exposed fishes within the first week. Fishes exposed to 0.0075 ppm of pesticide contained more than 1.0 ppm in gills and blood after only one hour. After 144 hours exposure gills, blood, and brain each contained more than 6.0 ppm as determined by gas chromatography. Dieldrin concentrations in the gut, liver, and muscle after 144 hours ranged from 2.0 ppm to over 8 ppm. The mortality rate was accelerated after twenty-four hours when all sampled tissues contained between 5 and 11 ppm of dieldrin. (Wahtola-Washington)
W71-01276

BEHAVIOUR OF LOBSTERS EXPOSED TO BLEACHED KRAFT MILL EFFLUENT,
Fisheries Research Board of Canada, St. Andrews (New Brunswick). Biological Station.
D. W. McLeese.
Journal of the Fisheries Research Board of Canada, Vol 27, p 731-736, 1970. 1 tab, 2 fig, 7 ref.

Descriptors: *Water pollution effects, *Lobsters, Behavior, Laboratory equipment.
Identifiers: Sea water, Bleached Kraft Mill effluents, Acetic Acid, Putrid cod, Pyridine, Ammonium hydroxide, Zinc chloride.

The behaviour of lobsters exposed to bleached Kraft Mill effluent and to other chemicals was described. In laboratory tests, lobsters (*Homarus americanus*) did not avoid bleached draft mill effluent (BKME) at concentrations up to 20%. BKME or fresh water introduced 50 cm upstream from resting lobsters did not elicit behavioural responses. Lobsters may have detected at least two (acetic acid and Ammonium hydroxide) of six toxic or malodorous materials but did not avoid any of them. Based on these results, it seems unlikely that exposure to dilute solutions of BKME in nature would have immediate, direct effects on movement of lobsters. (Wahtola-Washington)
W71-01277

COEXISTENCE OF A FISHERY AND A MAJOR INDUSTRY IN PLACENTIA BAY,
Fisheries Research Board of Canada, Halifax (Nova Scotia).
D. R. Idler.
Chemistry in Canada, December 1969, Reprint, 6 p, 2 tab, 8 fig.

Descriptors: *Pollution control, *Industry, *Commercial fishery, Mortalities, *Bioassay, Toxicity.
Identifiers: *Herring, *Cod, *Lobsters, *Phosphorous plant fluoride, Sulfur dioxide, Ammonia, Total phosphorus, Elemental phosphorus, Cyanide.

Steps taken to limit pollution from a phosphorus plant are described. The effluent before treatment produced 100% mortality in fish exposed to it. The plant was forced to build a large lagoon and several implant purification methods before it was allowed to pump effluent into the receiving stream. After treatment, there were no fish endangered by the effluent. (Wahtola-Washington)
W71-01279

MANHATTAN OIL CO V MOSBY (LIABILITY FOR POLLUTING STREAM BY ESCAPE OF SALT WATER FROM OIL WELL).
For primary bibliographic entry see Field 06E.
W71-01303

SYSTEMS STUDIES OF DDT TRANSPORT,
Wisconsin Univ., Madison. Dept. of Engineering; and American Trial Lawyers Association.
For primary bibliographic entry see Field 06A.
W71-01328

EFFECT OF OXYGEN CONCENTRATION ON THE RESPIRATION OF AQUATIC MACROPHYTES,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Thomas M. Bedick.
MS thesis in Sanitary Engineering, Pennsylvania State University, 1966. 54 p, 9 fig, 6 tab, 26 ref, 2 append. OWRR Project A-003-PA (3).

Descriptors: *Respiration, *Eutrophication, *Aquatic plants, *Oxygen, Phytoplankton, Benthos, Photosynthesis, Primary productivity, Biochemical oxygen demand, Temperature, Light, Phosphorus, Plant physiology, Alkalinity, Laboratory tests, Mathematical studies.
Identifiers: *Aquatic macrophytes, *Anacharis canadensis*, *Potamogeton crispus*, Reaction chambers, Oxygen meter, Regression equations.

Specimens of *Anacharis canadensis* and *Potamogeton crispus* were collected the night before analyses and acclimated for at least 12 hours to the temperature of that particular run. The plants were placed into sealed plexiglass tubes with a stirring device and allowed to respire under dif-

ferent conditions. The changes in oxygen concentration were recorded by a Pro Tech SM-125 meter. The relation between concentration and uptake of oxygen by both plant species was expressed by a straight line on an arithmetic plot. A rise in temperature from 10 to 20°C doubled or tripled respiration rates. Respiration rates remained the same in water of a natural stream and in BOD dilution water. A prolonged pre-trial exposure of plants to either light or darkness failed to influence the dark respiration rates. (Wilde-Wisconsin)
W71-01374

THE EFFECT OF ENVIRONMENTAL FACTORS ON THE RESPIRATION OF AQUATIC MACROPHYTES,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
Dennis W. Weeter.
MS thesis in Civil Engineering, Pennsylvania State University, 1968. 57 p, 9 fig, 5 tab, 33 ref, append. OWRR Project B-016-PA (1).

Descriptors: *Environmental effects, *Respiration, *Aquatic plants, Waste water (Pollution), Agriculture, Runoff, Industrial wastes, Eutrophication, Oxygen demand, Photosynthesis, Seasonal, Sewage treatment, Velocity, Dissolved oxygen, Temperature, Mathematical studies, Biochemical oxygen demand, Vascular tissues.
Identifiers: *Macrophytes, *Elodea canadensis*, *Potamogeton crispus*.

Experimental conditions described indicate the relationship between oxygen concentration and oxygen uptake for *Elodea canadensis* and *Potamogeton crispus* can be expressed as a straight line on either an arithmetic plot or log-log plot. The following conclusions apply to continuous flow respiration system data and to regression equations established for a linear oxygen uptake versus oxygen concentration relationship. Oxygen uptake values fall well within the range of oxygen uptake values expressed by others. There was a 1-1/2 to 2-1/2-fold increase in respiration with seasonal change for *Elodea canadensis* at 10°C and when 'polluted' stream plants were compared to 'clean' stream plants. For *potamogeton crispus* at 10°C and 15°C at the low dissolved oxygen values, the respiration of *P. crispus* 'polluted' was approximately equal to that of *P. crispus* 'clean,' but as dissolved oxygen increased, the slope of *P. crispus* 'polluted' regression equation was 1-1/4 to 1-1/2 times that of *P. crispus* 'clean.' Within the range of velocities, 0.10-0.40 millimeter/second, a change in velocity did not affect the respiration rate of the aquatic plants. (Jones-Wisconsin)
W71-01377

EUTROPHICATION-TROPHIC STATE RELATIONSHIPS IN NORTH AND CENTRAL FLORIDA LAKES,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 02H.
W71-01378

TICHENOR V WITHERSPOON (LIABILITY FOR DISCHARGE OF POLLUTANTS INTO STREAM).
For primary bibliographic entry see Field 06E.
W71-01416

OAKWOOD SMOKELESS COAL CORP V MEADOWS (LIABILITY FOR DAMAGE RESULTING FROM NORMAL OPERATION OF COAL MINE).
For primary bibliographic entry see Field 06E.
W71-01432

PRIMARY PRODUCTION AS A FUNCTION OF THE STRUCTURE OF PHYTOPLANKTONIC ASSOCIATION (IN RUSSIAN),
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 07B.
W71-01473

SOME ECOLOGICAL EFFECTS OF DISCHARGED WASTES ON MARINE LIFE, California Univ., San Diego; and Scripps Institution of Oceanography, San Diego, Calif.
Richard W. Grigg, and Robert S. Kiwala.
California Fish and Game, Vol 56, No 3, p 145-155, 1970. 2 fig, 4 tab, 10 ref.

Descriptors: *Ecology, *Wastes, *Marine animals, *Marine plants, Depth, California, Sands, Sediments, Productivity, Toxicity, Crabs, Algae, Invertebrates, Fish, Pollutants, Turbidity, Organic loading, Coral, Mollusks, Worms.
Identifiers: San Pedro (Calif), Epibenthic species, Abalone, Tunicates, Arthropods, Coelenterates, Bryozoa, Echinoderms.

Approximately one billion gallons of sewage are discharged daily into the shallow nearshore marine environment off Southern California. A survey was made of the effect of effluent on the biology of the area in 1954. The results of a 1969 survey to collect comparable data, and to examine these to detect possible long term ecological changes are described. The number of macroscopic species present at 5 diving stations ranging in depths from 45 to 65 feet, off the Palos Verdes Peninsula, near San Pedro, was negatively correlated to the amount of fine grain organic-laden sand present in the sediment. Organic rich sediments were thickest at stations near the outfall. Accumulation of this material at these depths appears to have modified or covered substrates otherwise suitable for the settlement of many epibenthic species. Fish, kelp, abalone and spiny lobster are particularly affected. Since bottom topography at White Point has not changed, decline of fishes, if not caused directly by toxic waste products, may indicate that relief is more important as a substrate for food rather than as a source of shelter or point of orientation. (Jones-Wisconsin)
W71-01475

QUANTITATIVE SAMPLING WITH THREE BENTHIC DREDGES, Bureau of Sport Fisheries and Wildlife, Yankton, S. Dak. North Central Reservoir Investigations.
Patrick L. Hudson.
Transactions of the American Fisheries Society, Vol 99, No 3, p 603-607, 1970. 2 fig, 1 tab, 8 ref.

Descriptors: *Sampling, *Benthos, Silts, Sands, Technology, Depth, Volume, Lakes, Missouri River, Reservoirs, Mud.
Identifiers: *Dredges, Chironomus plumosus, Ekman dredge, Ponar dredge, Orange-peel dredge, Hexagenia, Tanytopodinae, Pseudochironomus, Tanytarsus.

The sampling characteristics of the benthic dredges, 9x9-inch Ekman, the Ponar, and a Number 1 orange-peel dredge were tested in the laboratory and in the field. Sampling area and volume of bottom material collected were measured in the laboratory. Efficiency of the samplers with different bottom types and organisms were evaluated in the field. The Ekman dredge is restricted to soft and finely divided littoral bottoms of lakes, free from vegetation and intermixtures of sand and other coarse debris, which severely limits its application. Even in silty deposits it has been noted that it may not effectively sample the deeper burrowing Chironomus plumosus. However, it is useful with SCUBA because of its light weight; the sampler can be forced into the bottom and the jaws forcibly closed to assure a good grab. Bottom sampling requirements are so diverse that no one sampler has been devised to serve all purposes. Of the three samplers tested, the Ponar dredge is the most versatile and is only limited in deposits of silt over 12.7 centimeters. The orange-peel dredge, with its variable sampling characteristics and production of a shock wave, is of questionable value. (Jones-Wisconsin)
W71-01477

EUTROPHICATION CONTROL BY PLANT HARVESTING, Florida State Board of Health, Winter Haven. Midge Research Lab.
James L. Yount, and Roy A. Crossman, Jr.
Journal Water Pollution Control Federation, Vol 42, No 5, Part 2, p R173-R183, 1970. 2 fig, 1 tab, 28 ref. FWQA Grant WP-00216.

Descriptors: *Eutrophication, *Water pollution control, Water pollution effects, *Aquatic plants, Harvesting, Ponds, Water hyacinth, Nutrients, Midge, Fish, Lakes, Conductivity, Algae, Standing crop, Chemical analysis, Mosquitoes, Bacteria, Floating plants, On-site investigations, Turtles.
Identifiers: *Chironomids, Sawdust, Eichhornia crassipes, Salvinia rotundifolia, Milorganite, Gambusia affinis, Productivity measurements, Nutrient removal.

Data reported indicate that growing organisms in hypertrophic ponds and harvesting them to remove nutrients, reduce the ponds' primary productivity. This conclusion is confirmed by experiments showing that plant productivity was reduced in test ponds, while the control ponds, where nutrients were returned, productivity remained relatively high. Large-scale harvesting from natural waters can be expected to reduce the productivity of those waters, and probably reverse the trend toward hypertrophy, especially in polluted waters. The method of controlling the 'pest' water hyacinth and other plants by chemical sprays is recirculating their nutrients to lakes and exacerbating hypertrophy. Given a constant inflow of pollutants, if too much vegetation is removed, then availability of these pollutants to other organisms would increase. The problem is resolved by managing a population on a sustained-yield basis. Harvesting hyacinths from effluent streams might prove a more practical method for handling excessive nutrients than by harvesting from lakes. (Jones-Wisconsin)
W71-01488

EFFECTS OF FOREST CUTTING AND HERBICIDE TREATMENT ON NUTRIENT BUDGETS IN THE HUBBARD BROOK WATERSHED-ECOSYSTEM, Dartmouth Coll., Hanover, N.H. Dept. of Biological Sciences; Yale Univ., New Haven, Conn. School of Forestry; Geological Survey, Washington, D.C.; and Forest Service, (USDA), Durham, N.H. Northeastern Forest Experiment Station.
For primary bibliographic entry see Field 02A.
W71-01489

EXPERIMENTAL EVIDENCE OF CHEMICAL WEED ERADICATION IN LAKE TRASIMENO (IN ITALIAN), Perugia Univ. (Italy). Inst. of Hydrology and Fish Culture.
For primary bibliographic entry see Field 02H.
W71-01493

ENGINEERING ASPECTS OF NUTRIENT REMOVAL, Wisconsin Univ., Madison. Water Resources Center.
Gerard A. Rohlich.
Eutrophication: Causes, consequences, correctives, p 37-382. Printing and Publishing Office, National Academy of Sciences, Washington, D.C., 1969. 3 tab, 23 ref.

Descriptors: *Nutrients, *Sanitary engineering, *Waste treatment, Phosphates, Phosphorus, Nitrogen, Biochemical oxygen demand, Aluminum, Flow rates, Hydrogen ion concentration, Industrial wastes, Municipal wastes, Suspended load, Ammonia, Wisconsin, Illinois, Texas, Sewage treatment, Costs.
Identifiers: Madison (Wis), Chicago (Ill), San Antonio (Tex).

The history of controlling nutrients in water bodies, design and construction of engineering works

should be based on origins and quantities of nutrients, sources most readily subject to control, cost, and anticipated results. Ion exchange for nitrogen removal is discussed. Ammonia nitrogen may be removed by desorption in a tower packed with Raschig rings. Chemical methods have received more attention for removing phosphorus than nitrogen. Results of chemical treatment of sewages with ferric chloride are reported. Studies of an operating plant showed that mixing, flocculation, and settling are inefficient. Aluminum sulfate in the form of 'filter alum' is used as coagulant, and a process developed for its recovery. Lime, alum, and sodium hydroxide have been utilized for removal of phosphorus and nitrogen compounds. Biological methods, by which living organisms incorporate nutrients into protoplasmic structure, process flow systems, stabilization ponds, and removal of nitrogen and phosphate in the activated sludge process are evaluated. Diversion and irrigation may also reduce nutrient input to receiving waters. (See also W70-03975) (Jones-Wisconsin)
W71-01499

URBAN DRAINAGE AS A FACTOR IN EUTROPHICATION, Public Health Service, Washington, D.C.
S. R. Weibel.

Eutrophication: Causes, consequences, correctives, p 383-403. Printing and Publishing Office, National Academy of Sciences, Washington, D.C., 1969. 2 fig, 9 tab, 32 ref.

Descriptors: *Eutrophication, *Drainage effects, Path of pollutants, Sewage, Storm runoff, Overflow, Rainfall, Sewers, Urbanization, Drainage, Interception, Costs, Waste water treatment, Storm runoff.
Identifiers: *Urban drainage, Rain water utilization.

The problems of urban drainage integrating sewage, storm-water runoff, and sewer outflows are reviewed. Attention is given to conditions anticipated at the end of the century when some 1/4 billion population is likely to be concentrated on 11% of the land. Following an account of the contributors to the urban drainage, possibilities are outlined as to the interception of rain, especially storm waters, and its use for cooling, watering gardens, recharging the ground, filling ornamental ponds, etc. Suggested preventive measures include diversion of storm-water drainage, dilution of lake water with oligotrophic water, use of ground recharge basins, partial and complete separation of sewers, storage in combined-outlet sewers and combined-outflow tunnels, treatment and monitoring combined-sewer overflows, and storm-water tanks. Some of these improvements are exemplified by constructions now in existence in the USA and Canada. (See also W70-03975) (Wilde-Wisconsin)
W71-01500

ON THE SOARING OF NON-MOTILE PLANKTONIC ALGAE, Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.
For primary bibliographic entry see Field 02H.
W71-01511

ORGANIC MATERIALS IN THE MARINE ENVIRONMENTS AND THEIR INTERACTIONS WITH SOME METAL IONS, Bhabha Atomic Research Centre, Bombay (India). Health Physics Div.
For primary bibliographic entry see Field 05B.
W71-01523

AIR AND WATER POLLUTION, For primary bibliographic entry see Field 06E.
W71-01565

THE WATER CRISIS, For primary bibliographic entry see Field 06E.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5C—Effects of Pollution

W71-01566

MAIER V PUBLICKER COMMERCIAL ALCOHOL CO (LIABILITY FOR POLLUTION AS PRIVATE NUISANCE).

For primary bibliographic entry see Field 06E.
W71-01567

SEGARS V CITY OF CORNELIA (EASEMENT TO DISCHARGE SEWAGE).

For primary bibliographic entry see Field 06E.
W71-01581

G L WEBSTER CO V STEELMAN (ABATEMENT OF STREAM POLLUTION CAUSED BY CANNERY).

For primary bibliographic entry see Field 06E.
W71-01582

SEGARS V CITY OF CORNELIA (CITY'S LIABILITY FOR WASTE POLLUTION OF STREAM).

For primary bibliographic entry see Field 06E.
W71-01583

COMMONWEALTH V PHILADELPHIA AND READING IRON AND COAL CO (POLLUTION OF WATER SUPPLIES AS PUBLIC NUISANCE).

For primary bibliographic entry see Field 06E.
W71-01599

HUBER V CITY OF BLUE EARTH (MERE PASSING OF CITY ORDINANCE NOT EFFECTIVE AS DEFENSE TO STREAM POLLUTION FROM SEWER).

For primary bibliographic entry see Field 06E.
W71-01612

DU PONT RAYON CO V RICHMOND INDUSTRIES, INC (RIPARIAN RIGHT TO USE WATER VERSUS PUBLIC RIGHT TO USE STREAM FOR SEWAGE).

For primary bibliographic entry see Field 06E.
W71-01631

ECKART V CITY OF BELLEVILLE (CITY'S LIABILITY FOR WATER POLLUTION CAUSED BY DISCHARGE OF RAW SEWAGE INTO STREAM).

For primary bibliographic entry see Field 06E.
W71-01637

NEWKIRK V CITY OF TIPTON (SUIT FOR DAMAGES FOR REDUCTION IN LAND VALUE BECAUSE OF POLLUTION OF A STREAM).

For primary bibliographic entry see Field 06E.
W71-01640

5D. Waste Treatment Processes

APOLLO 12 WATER SERVICING,

National Aeronautics and Space Administration, Cocoa Beach, Fla. John F. Kennedy Space Center. A. P. Buck, V. E. Christiansen, P. La Torre, and E. Wright.

Available from NTIS as N70-18466, \$3.00 in paper copy, \$0.95 in microfiche. December 19, 1969, various pagings. NASA GP-804.

Identifiers: *Apollo 12 flight, *Potable water, *Space vehicle checkout program, Life support systems, Waste water treatment, Water treatment.

The complete documentation of the water servicing for Apollo 12 is presented. The scope of water servicing includes the verification of facility demineralized water, ground support equipment water units, lunar module, command module spacecraft, portable life support system, liquid cooling garment and sterilization of water dispen-

sers. None of the analysis reports failed the specifications during the entire chamber tests except for the sterility requirements, which were expected due to the lack of a bactericide, and there were detectable increases of the ionic species for nickel, magnesium and zinc in the command module use ports. The sterilization of the water dispenser procedure was modified by increasing the iodine bactericide solution to 80-100 parts per million.
W71-01171

DEVELOPMENT OF AN IMPROVED TUBULAR REVERSE OSMOSIS MODULE FOR WATER TREATMENT,

Philco-Ford Corp., Newport Beach, Calif.

For primary bibliographic entry see Field 03A.
W71-01199

USE OF A CONTINUOUS STREAMFLOW SIMULATOR IN WATER RESOURCES DESIGN,

Pittsburgh Univ., Pa., and Pennsylvania Dept. of Forest and Waters, Harrisburg.

For primary bibliographic entry see Field 05G.
W71-01210

BIOLOGICAL WASTE TREATMENT IN THE FAR NORTH,

Federal Water Quality Administration, College, Alaska. Alaska Water Lab.

Sidney E. Clark, Harold J. Coutts, and Conrad D. Christianson.

Available from NTIS as PB-195 673, \$3.00 in paper copy, \$0.95 in microfiche. Federal Water Quality Administration Report 1610—June 1970, 36 p, 3 fig, 4 tab, 112 ref, append. FWQA-AWL Program 1610—06/70.

Descriptors: *Sewage treatment, *Biological treatment, *Sewage lagoons, *Activated sludge, *Oxidation ponds, Sewage disposal, Aerobic treatment, Stabilization ponds, Sewage disposal, Waste disposal, Waste water disposal, Waste treatment, Oxidation lagoons, Waste water treatment, *Reviews, Bibliographies.

Identifiers: *Arctic sewage treatment, *Low temperature biological treatment, *Arctic sewage lagoons, *Low temperature activated sludge, *Cold regions extended aeration.

A literature review to establish the state-of-the-art of biological waste treatment for cold regions applications was conducted. Comments were solicited from operating agencies throughout the cold regions of the Northern Hemisphere, particularly in the United States and Canada. These agencies have provided discussion of their experiences and offered their recommendations through letters and other forms of personal communications. The review centers on the feasibility for cold regions application of lagoons (aerated, facultative, and anaerobic) and extended aeration (12 to 36 hour detention activated sludge) with emphasis placed on the effectiveness of processes at low temperatures while treating domestic sewage. Although definite design criteria are not established, many of the recommendations and conclusions provide a better basis for cold regions design of biological waste treatment facilities. The limitations of existing knowledge are expressed and recommendations for continued research are presented.
W71-01262

MICROTRAINING AND DISINFECTION OF COMBINED SEWER OVERFLOWS,

Crane Co., King of Prussia, Pa. Cochrane Div.

George E. Glover, and Peter M. Yatsuk.

Available from NTIS AS PB-195 674, \$3.00 in paper copy, \$0.95 in microfiche. Water Pollution Control Research Series 11023 EVO 06/70, June 30, 1970. 75 p, 7 tab, 16 fig, 12 ref. FWQA Contract 14-12-136. FWQA Program 11023 EVO.

Descriptors: *Sewers, *Storm runoff, *Filtration, *Water pollution control, *Cost comparisons,

Water Quality, Ozone, Chlorine, Biochemical oxygen demand.

Identifiers: *Microstraining, *Combined sewer overflow, *Suspended solids removal.

Microstraining (C) Copyrighted Trade Name—Crane Co., Glenfield and Kennedy Div., using a Microstrainer screen of a nominal aperture of 23 microns, removed up to 98% of the suspended solids from a combined sewer overflow. The sewer, in a residential area of Philadelphia, has an average dwf of 1,000 gph. The maximum combined sewer flow during rainstorms in one year of operation was 304,000 gph (11.3 cfs). Volatile suspended solids removals with the above screen have averaged 68% and 71% during different test periods. Results indicated that there was a slightly better kill of coliform group bacteria with chlorine than with ozone in the Microstrainer effluents when both were used at an initial nominal concentration of 5 ppm, with 5 to 12 minutes detention time. However, chlorine was applied at slightly higher levels and with better control than ozone. Preliminary estimates of the costs of treatment via Microstraining, using tentatively-established throughput rates, show that the capital costs per acre of drainage would be approximately \$10,200 for Microstraining alone, \$11,200 for Microstraining plus chlorination, and \$19,800 for Microstraining plus ozonation. Of eight other currently-proposed schemes, whose costs were estimated, only surface impoundment (where aesthetically acceptable and where low cost land is available) appears competitive.

W71-01263

COMBINED SEWER REGULATION AND MANAGEMENT.

American Public Works Association, Chicago, Ill. Research Foundation.

For primary bibliographic entry see Field 05G.
W71-01265

COEXISTENCE OF A FISHERY AND A MAJOR INDUSTRY IN PLACENTIA BAY,

Fisheries Research Board of Canada, Halifax (Nova Scotia).

For primary bibliographic entry see Field 05C.
W71-01279

ENGINEERING REPORT ON COUNTY WIDE WASTE WATER INTERCEPTING AND TREATMENT FACILITIES.

Consoer, Townsend and Associates, Chicago, Ill.

DuPage County Department of Public Works, Wheaton, Illinois, July 1968. 133 p, 16 fig, 11 tab.

Descriptors: *Waste water treatment, *Waste water, *Water quality control, *Water pollution, *Urbanization, Sewerage, Sewage treatment, Sewers, Illinois, Water reuse, Construction costs, Operating costs, Cost comparisons, Financing, Municipal wastes, Planning, Illinois.

Identifiers: *Waste water treatment facilities, *Interceptor sewers, DuPage County.

A comprehensive study was made of two possible systems for meeting the waste water treatment facility needs of the fastest growing county in Illinois. One system would include a network of intercepting sewers throughout DuPage County to collect all waste waters from local sewer systems for conveyance to a large single waste water treatment plant. The other system would consist of nine separate waste water treatment plants distributed throughout the County and a network of intercepting sewer systems. The single plant system was recommended by the engineers, primarily because of the economies of scale. It would replace 80 plants presently treating about 50 mgd and serving 325,000 persons. The system, proposed for 67 mgd initially, would cost about \$119 million compared to only \$110 million for the multi-plant design; however, the total estimated operating cost for a 15-year period (1970-1985) would be less -- \$29.9

million compared to \$43.6 million. The County's share of the cost is proposed to be financed through both revenue bonds and general obligation bonds. State and federal aid is suggested. The proposed system would utilize activated sludge treatment, tertiary treatment, and, possibly, filtration and chlorination. Reuse is discussed of treated waste water as potable water, although the proposed facilities do not contemplate this feature initially. The additional facility costs would be approximately \$38.6 million, and 1985 annual operating and maintenance costs are estimated at \$2.4 million, or \$0.22.6/1,000 gal. (Poertner)
W71-01337

THE ORGANIC GRADIENT IN A CONCENTRATION COLUMN,

Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.

Bong T. Kown.

Available from NTIS as PB-195 777, \$3.00 in paper copy, \$0.95 in microfiche. New Jersey Water Resources Research Institute, Rutgers University, New Brunswick, New Jersey, Oct 1970. 47 p, 17 fig, 15 ref. A-015-N.J. (1).

Descriptors: *Water quality, *Water pollution, *Separation techniques, *Water purification, Foam fractionation, Waste water treatment.

Identifiers: *Bubble fractionation, Gas liquid interface.

A continuous bubble fractionation system consisting of vertical tube provided with a source of air bubbles, means of continuous liquid feed, overflow, and bottom effluent has been studied. The study primarily involves an examination of the effects of variables, such as gas rate, liquid rates, solute concentration and column size, on the effectiveness of the system for separating an organic solute from a dilute aqueous solution. The effects of gas and liquid rate on the performance have generally followed the results expected from an equilibrium adsorption of a surfactant on the gas-liquid interface described by Gibbs' equation and material balances. An increase in gas rate increased the effectiveness of the system by providing more adsorption surface. The adverse transfer of the solute by the eddy diffusion, caused by rising bubbles was found to be the factor limiting the effectiveness of the system. Part II of the report considers effects of variations in the height and diameter of the column upon solute concentration profile and effectiveness of the column. Column heights above 30 cm were found to have little effect upon performance, and increases in column diameter greatly reduced effectiveness. (Whipple-Rutgers)
W71-01340

ALTERNATE METHODS OF FINANCING WASTE TREATMENT FACILITIES,

Union Securities and Co., New York.

For primary bibliographic entry see Field 06B.

W71-01355

UTILITIES: NEW TECHNIQUES, AND THEIR APPLICATION TO THE MUSKEGON COUNTY AREA, A WORKING PAPER REPORT.

Sheafer (John R.) and Associates, Wheaton, Ill.

Muskegon County Metropolitan Planning Commission, Muskegon, Michigan, August 1970. 21 p, 1 fig, 326 ref.

Descriptors: *Municipal wastes, *Treatment facilities, *Waste water treatment, *Water pollution control, Environment, Michigan, Irrigation water. Identifiers: *Metropolitan water resources management, Environmental problems, Environmental quality, Urban environment, Urban ecology, *Muskegon County (Michigan).

The report combines previous studies which updated the 'Muskegon County Waste water Management Plan' of May 1969. The Muskegon plan entailed the collection of treatment of waste water

and the irrigation of waste water on land located outside the urban core. The county was able to secure the cooperation of a large industry, a paper mill using great amounts of water. A lagoon specialist assisted in the aeration lagoon design and feasibility study. Virus control through waste water irrigation was also studied and showed promise. Further research was conducted in four areas: (1) system inputs, (2) waste water transportation, (3) waste water treatment, and (4) agricultural waste water irrigation. The county's plan showed a great ability to absorb shock loads (industrial dumping) of toxic materials because of the greater volume of the biological treatment units and the system's ability to hold wastes for long periods of times. Present levels of trace elements in the waste water are not likely to interfere with its use as irrigation water. Simulation studies show that odors can be avoided. Field investigations established the feasibility of groundwater control within the irrigation site study areas. Irrigation agriculture studies concluded that perennial grasses can be harvested during the early years and crop production or beef cattle operations later. Muskegon's waste water plan shows promise for improving land for agriculture and upgrading water quality. (Wray-Chicago)
W71-01372

INACTIVATION OF VIRUS IN NATURAL WATER AND WASTE WATER BY SILICATE MINERALS,

Maine Univ., Orono. Dept. of Civil Engineering.

Shiao Huei Lo.

MS thesis in Civil Engineering, University of Maine, 1970. 51 p. OWRR Project A-013-ME (2).

Descriptors: *Waste water treatment, *Viruses, *Silicates, Domestic wastes, Effluents, Filters, Testing.

Identifiers: *Poliomyelitis virus, Silicate filter beds, Decontamination, Actinolite, Enstatite, Kyanite, Microcline, Olivine, Sillimonite.

In the batch trials from 64,000 to 89,000 plaque forming units of polio virus were adsorbed per mg of silicate minerals ranging in size from 1 to 10 microns. The proteinaceous material in natural waters and waste waters not only competed for adsorption sites, but also desorbed the virus from the minerals. As revealed by a column study, organic matter interfered with inactivation of the virus in silicate filter beds used for treatment of domestic waste water. Removal of 99.5% of the polio virus Type 1 from a biologically treated effluent was achieved in a column of microcline in 7 days at a constant flow of 15 gpd/sq ft. A similar decontamination of a simulated natural water system required 12 days. (Wilde-Wisconsin)
W71-01376

MINIMAL COST ESTIMATION FOR LAKEFRONT SEWAGE SYSTEMS,

New Hampshire Univ., Durham. Water Resources Research Center.

For primary bibliographic entry see Field 06B.

W71-01410

BIOLOGICAL UPTAKE OF PHOSPHORUS BY ACTIVATED SLUDGE,

Arizona Univ., Tucson. Dept. of Microbiology and Medical Technology.

Irving Yall, William H. Boughton, Richard C.

Knudsen, and Norval A. Sinclair.

Applied Microbiology, Vol 20, No 1, p 145-150, 1970. 5 fig, 2 tab, 10 ref. FWQA supported.

Descriptors: *Phosphorus, *Activated sludge, Phosphorus radioisotopes, Sewage, Radioactivity, Phosphates, Chemical analysis, Algae, Microorganisms, Hydrogen ion concentration, Phenols, Arizona.

Identifiers: *Biological uptake, Calcium radioisotopes, Blooms, 2,4 dinitro phenol, Tucson (Ariz).

Experiments to reproduce conditions possibly existing in an optimally aerated, plug flow activated sludge unit are reported. Ability of activated sludge to remove phosphates was studied by adding carrier-free phosphorus-32 to raw sewage and measuring incorporation of radioactivity into cells. Radioisotope determinations indicated that 48% of phosphorus-32 radioactivity was removed in 12 hours. Chemical methods indicated that only 30% of orthophosphate apparently disappeared from the sewage during this period. Experiments with sludge relabeled with phosphorus indicated considerable phosphate turnover. Cells released large amounts of radioactivity as they were incorporating fresh phosphates. Starvation in isotonic saline for 18 hours caused sludge to dump phosphate. When introduced into fresh sewage containing phosphorus-32, the starved sludge removed about 60% of the radio-activity in 6 hours with little phosphate turnover. Ability of sludge to remove phosphorus-32 was inhibited approximately 83% by 0.001 molar 2,4-dinitro phenol. This inhibition was at the expense of the cell fraction that contained ribo-nucleic acid and deoxyribonucleic acid. The sludge cells released orthophosphate when exposed to the chemical agent. Experiments using calcium-45 indicated that calcium phosphate precipitation plays a minor role in phosphate removal under experimental conditions. (Jones-Wisconsin)
W71-01474

FILTRATION TECHNIQUES IN TERTIARY TREATMENT,

Stanford Univ., Calif. Dept. of Civil Engineering.

George Tchobanoglous.

Journal Water Pollution Control Federation, Vol 42, No 4, p 604-623, 1970. 16 fig, 8 tab, 18 ref. FWQA Grant WPD21-05.

Descriptors: *Filtration, *Tertiary treatment, *Waste water treatment, Technology, Effluents, Suspended load, Solid wastes, Distribution, Dissolved solids, Conductivity, Activated sludge, Chlorine, Turbidity, Chemicals, Design. Identifiers: Surface charge, Flocc strength, Ionic strength, Anthracite, Ferric chloride, Polyelectrolytes, Mass balance analysis.

In dealing with various aspects of filtration, studies evaluating filter bed performance indicate: removal efficiency for the filtration of settled secondary effluent without the addition of chemicals is primarily a function of grain size; typical removal efficiencies using conventional single medium sand or anthracite filter beds with depths of 18-30 inches (45.7-76.2 centimeters) will vary, depending on grain size, from 10-60%. In filtration of settled effluent, with and without the addition of chemicals, turbidity break throughs were not observed within the headloss range studied—8-10 feet (2.4-3.0 meters); in present designs, the sand layer is most dual medium (anthracite and sand) filter beds is not utilized effectively; in multi-media filter beds, if the anthracite layer is greater than 16-20 inches (41-51 centimeters), media placed below the anthracite contributes little to overall suspended solids removal; polyelectrolytes can be used as an additive to achieve varying degrees of suspended solids removal from secondary effluents using single-, dual-, and multi-media filter beds. Distribution of suspended solids removed within a filter bed can be controlled by varying amount and point of addition of polyelectrolytes. (Jones-Wisconsin)
W71-01479

ADVANCED WASTEWATER TREATMENT,

Smith and Loveless, Lenexa, Kans. Research and Development Dept.

Brian L. Goodman, and Kenneth A. Mikkelsen.

Chemical Engineering, Vol 77, No 9, p 75-83, 1970. 11 fig, 1 tab, 33 ref.

Descriptors: *Waste water treatment, *Phosphorus, *Suspended load, *Solid wastes, Biochemical oxygen demand, Chemical precipitation, Effluents, Filtration, Separation techniques,

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5D—Waste Treatment Processes

Hydrogen ion concentration, Operating costs, Monitoring, Mathematical models, Iron, Aluminum, Sludge, Economics, Filters.

Identifiers: Polyelectrolytes, Biological-chemical process, Polymers, Dual-media filter, Suspended solids.

The combined biological-chemical process offers inherent simplicity, low capital cost and ease of integration into conventional activated sludge plants. For efficiency the combined process requires low sludge age, proper point of chemical addition and effective solid-liquid separation in final clarification step. Basically, soluble phosphorus is converted to insoluble form by complexing with metallic ions coupled with microbial phosphorus assimilation, and incorporation of insoluble phosphorus into sludge mass and its removal from the liquid phase by efficient solids-liquid separation device. Synthetic organic polyelectrolytes are utilized for particle agglomeration and removal; modification of conventional clarifier design to use the clarifier floc blanket as a filtering device improves clarification. Incorporation of automatically-actuated backwash cycles, quality monitoring, proper flow distribution, efficient 'cleansing' of the media between cycles, proper design of systems, duration of filtration cycles are important. Due to relatively low dosage needed to achieve substantial increase in settling rate, water soluble, cationic polymers are best suited, generally. After an initial polymer treatment, the dosage was reduced to 1/5. Effluent solids concentration then fell to an acceptable level, maintained until polymer addition was terminated. Following polymer treatment, the beneficial effect decayed with time. (Jones-Wisconsin)

W71-01480

EVALUATION OF THE POLLUTION LOAD OF RESIDUAL WATERS FROM WINE DISTILLERIES (IN FRENCH),

Institut National de la Recherche Agronomique, Narbonne (France). Station Centrale de Technologie des Produits Vegetaux.

J. Mourgues, and J. Maugenet.
English summary. Annales de Technologie Agricole, Vol 18, No 2, p 129-137, 1969. 2 fig, 3 tab.

Descriptors: *Waste water treatment, *Industrial wastes, Water pollution sources, Effluents, Biochemical oxygen demand, Chemical oxygen demand, Phenols, Biodegradation, Analysis.
Identifiers: *Wine distillation effluents, Polyphenols, Tannins, 5-day biochemical oxygen demand.

Analyses of effluents from several wine distilleries yielded an approximate average chemical oxygen demand of 0.24% and a 5-day biochemical oxygen demand of 0.14%. Ethanol, glycerol, lactic acid, acetic acid, and polyphenols exhibited high COD exceeding 1 gram of oxygen/gram of the substance; the COD of tartaric acid was about 0.5. All ingredients of the effluent, except polyphenols, are readily biodegradable. It is advisable to eliminate polyphenols by either chemical precipitation or decomposition by an appropriate microflora prior to the discharge of the residual liquor. The degree of pollution by the effluent is indirectly related to the quality of distilled wine, the inferior piquette grade providing the maximum load of pollutants. (Wilde-Wisconsin)

W71-01486

ENGINEERING ASPECTS OF NUTRIENT REMOVAL,

Wisconsin Univ., Madison. Water Resources Center.

For primary bibliographic entry see Field 05C.
W71-01499

5E. Ultimate Disposal of Wastes

DEVELOPMENT OF A PROTOTYPE WASTE COLLECTION SYSTEM (THE HYDRO-JOHN), General Electric Co., Philadelphia, Pa. Space Div.
For primary bibliographic entry see Field 05G.
W71-01124

FURTHER CONSIDERATIONS ON INLAND SEWAGE DISPOSAL IN FALMOUTH, MASSACHUSETTS, Geological Survey, Woods Hole, Mass.
Robert H. Meade.
Woods Hole Oceanographic Institution Technical Report, Reference No 70-42, September 1970. 24 p, 5 fig, 2 tab, 6 ref. 3 append. (Unpublished manuscript).

Descriptors: *Sewage disposal, *Infiltration, *Water spreading, *Monitoring, Water pollution sources, Sewage treatment, Waste water disposal, Nitrates, Eutrophication, Aquifers, Groundwater movement, Massachusetts.
Identifiers: Infiltration ponds, Cape Cod (Mass), Falmouth (Mass).

If the town of Falmouth, Mass., decides to dispose of secondary-treated sewage effluent at an inland site, the groundwaters downstream of the disposal site should be monitored carefully, and adequate space and access for more advanced waste-treatment facilities should be included in the plant in case the monitoring shows that deleterious substances are beginning to contaminate the groundwater. The present inland sewage disposal plant at Otis Air Force Base has no significant effect on groundwater quality at its present low level of operations. Effluent from a proposed inland site could contaminate nearly groundwater and contribute to the overfertilization of estuaries in southern Falmouth. Disposal of 3.7 mgd of effluent through a sea outfall could result in a general decline in groundwater levels of 3 to 5 inches; therefore, careful disposal by recharge is recommended to conserve groundwater. (Knapp-USGS)

W71-01205

CONSIDERATIONS ON INLAND SEWAGE DISPOSAL IN FALMOUTH, MASSACHUSETTS, Woods Hole Oceanographic Institution, Mass.
Robert H. Meade, and Ralph F. Vaccaro.
Technical Report, Reference No 70-3, February 1970. 22 p, 4 fig, 1 tab, 9 ref, 2 append. (Unpublished manuscript).

Descriptors: *Infiltration, *Water spreading, *Monitoring, Water pollution sources, Sewage treatment, Waste water disposal, Nitrates, Eutrophication, Aquifers, Groundwater movement, Massachusetts.
Identifiers: Infiltration ponds, Cape Cod (Mass), Falmouth (Mass).

The consequences are considered of disposing of secondary treated effluent from the town of Falmouth, Mass., by infiltration inland sites rather than by marine outfalls. For the terminal disposal of treated sewage effluents, transfer into the ground can be an acceptable and effective method. Very many sewage treatment plants operate in this manner. In many instances, such practice enhances water conservation by helping maintain groundwater reserves. However, in towns such as Falmouth, which depend upon groundwater for potable water, great care must be taken to assure that recharging does not cause any undue contamination of the local groundwater system. Nitrate is one of the more unpredictable by-products of sewage treatment and its ultimate appearance in natural waters can have an adverse effect on water quality. Excessive amounts of nitrate, in conjunction with other plant nutrients, can lead to unsightly blooms of nuisance aquatic plants once exposure to sunlight is provided. Adequate allowance for this uncertainty should be provided at the planning stages of any inland sewage disposal plant which depends

upon terminal disposal into the ground. An early-warning monitoring system of observation wells near the disposal site is recommended to detect any incipient contamination problem before it becomes serious. (Knapp-USGS)

W71-01324

HAMPTON V TOWN OF SPINDALE (DISCHARGE OF INDUSTRIAL WASTES INTO MUNICIPAL SEWER SYSTEM).
For primary bibliographic entry see Field 06E.
W71-01437

LAND BURIAL OF SOLID RADIOACTIVE WASTES: STUDY OF COMMERCIAL OPERATIONS AND FACILITIES, Division of Reactor Development and Technology (AEC), Washington, D.C. Environmental and Sanitary Engineering Branch.
Roy J. Morton.
Available from NTIS as WASH-1143, \$3.00 in paper copy, \$0.95 in microfiche. 1968. 133 p.
Identifiers: *Radioactive waste, Disposal, Safety, Geology, Hydrology, *Solid waste disposal.

This study reviews current practice in the disposal of solid radioactive wastes by land burial. The primary purpose was to assemble information and develop conclusions regarding commercial waste burial operations on government-owned sites and to submit recommendations for such operations in the future. The disposal of radioactive mill tailings was excluded; shallow ground disposal of the most highly radioactive solid wastes was also precluded. The facilities and procedures at five waste burial sites, during the time period 1962-1966, were considered. This report also emphasizes the factors affecting the health and safety of the public which are of primary importance in the appraisal of ground disposal sites and evaluation of radioactive waste handling and land burial procedures.

W71-01501

WASTE MANAGEMENT CONCEPTS FOR THE COASTAL ZONE, REQUIREMENTS FOR RESEARCH AND INVESTIGATION.

National Academy of Sciences-National Research Council, Washington, D.C. Committee on Oceanography.
For primary bibliographic entry see Field 05G.
W71-01544

5F. Water Treatment and Quality Alteration

NON-CHOLERA VIBRIOS OF EGYPTIAN SURFACE WATERS, Naval Medical Research Unit No. 3, Cairo (Egypt).
W. R. Sanborn, A. W. Wahba, P. E. Ewald, and Abdalla S. Diab.
Available from NTIS as AD-704 247, \$3.00 in paper copy, \$0.95 in microfiche. Published in Journal of the Egyptian Public Health Association, Vol 43, No 4, p 320-328, 1968.
Identifiers: *Vibrio, Identification, Egypt, Water, Agglutinins, Detection, Bacteria, Cholera.

A schema for the isolation and identification of vibrios from water samples is described. All the Heiberg biochemical groups of vibrios may be found in Egyptian surface waters. Group I and II were the most common strains found in Nile water. No agglutinable vibrios were discovered. Non-agglutinable vibrios can exist in an environment where cholera is absent. These were isolated in two successive years.

W71-01161

APOLLO 12 WATER SERVICING, National Aeronautics and Space Administration, Cocoa Beach, Fla. John F. Kennedy Space Center.
For primary bibliographic entry see Field 05D.
W71-01171

BIOLOGICAL AND CHEMICAL ASPECTS OF RHINE WATER IN THE BERENPLAAT RESERVOIR.
Drinkwaterleiding der Gemeente Rotterdam (Netherlands).
John J. Rook, and Gijsbert Oskam.
Journal American Water Works Association, Vol 62, No 4, p 249-259, 1970. 10 fig, 7 tab, 30 ref.

Descriptors: *Water purification, *Detention reservoirs, Reservoirs, Photosynthesis, Dissolved oxygen, Phosphates, Water yield improvement, Water pollution treatment, Algae, Potable water, Taste, Ammonia, Silica.
Identifiers: Rhine River, Asterionella formosa, Cryptomonas, Chlamidomonas, Berenplaat Reservoir (Rotterdam), The Netherlands.

A considerable purification of the highly polluted water of the Rhine River is achieved by its relatively brief storage in a retention reservoir. The high level of river's fertility induces a heavy growth of algae, particularly Asterionella formosa. The storage and re-aeration of the algal suspension promotes photosynthesis and restores the content of dissolved oxygen. An occasional increase in dissolved organic matter in the reservoir has failed to produce unfavorable effects on potassium permanganate consumption. The growing algae utilize large amounts of phosphates and silica; the latter appears to act as a limiting factor. The ammonia content is reduced by loss to the atmosphere and by nitrification, the nitrates presumably contributing to the dissimilation of settled organic matter. The most important benefit of the storage of Rhine water is the striking reduction in threshold taste value. The algae are withdrawn from the reservoir prior to their completion of the life cycle. An opinion is expressed that the Netherlands will build many new Rhine reservoirs. (Wilde-Wisconsin)
W71-01491

5G. Water Quality Control

GEOLOGY FOR PLANNING AT CRESCENT CITY, ILLINOIS.
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 03D.
W71-01111

SCIENCE AND TECHNOLOGY AND ITS APPLICATION TO THE PROBLEMS OF POLLUTION, TRANSPORTATION AND EMPLOYMENT. PUBLIC SCIENCE POLICY: BACKGROUND READINGS.
Federation of Rocky Mountain States, Inc., Denver, Colo.
For primary bibliographic entry see Field 06G.
W71-01118

DEVELOPMENT OF A PROTOTYPE WASTE COLLECTION SYSTEM (THE HYDRO-JOHN).
General Electric Co., Philadelphia, Pa. Space Div. R. W. Murray, and J. J. Reville.
Available from NTIS as N70-28007, \$3.00 in paper copy, \$0.95 in microfiche. February 1970. 73 p. NAS 9-9741.
Identifiers: *Human wastes, *Sanitation, *Waste disposal, Cleanliness, Environmental control, Equipment specifications, Hygiene, Systems engineering.

The prototype waste collection system described demonstrates spacecraft type sanitary urine and feces collection techniques for male personnel. The system features a manually initiated, automatically controlled anal wash and dry cycle after defecation as well as a feces/wash water blending and discharge cycle. It also features an adjustable urinal which is designed to collect urine while preventing spillage during micturition. Both the feces and urine collection techniques are designed for use in either a zero or one gravity environment. Overall reactions to the system by eight users were favorable and are defined.
W71-01124

EVALUATION OF THE HAZARD OF BULK WATER TRANSPORTATION OF INDUSTRIAL CHEMICALS: A TENTATIVE GUIDE.
National Academy of Sciences-National Research Council, Washington, D.C.
For primary bibliographic entry see Field 05B.
W71-01135

RADIOACTIVITY IN WATER: PROJECT RULISON,
Teledyne Isotopes, Palo Alto, Calif.
William E. Nork, and Paul R. Fenske.
Available from NTIS as NVO-1229-131, \$3.00 in paper copy, \$0.95 in microfiche. February 1970. 14 p. AT (29-2)-1229.
Identifiers: *Petroleum industry, *Nuclear explosions, *Hydrology, *Radioactive isotopes, Underground explosions, Rulison operation, *Natural gas.

The Project RULISON detonation was wholly contained, as planned, within the rocks of the Mesaverde Group. Explosion-produced radioactivity was initially distributed non-uniformly in the collapsed chimney and fractured rock surrounding the working point, WP. Redistribution of the explosion-radioactivity will occur as a result of transport of dissolved and/or particulate matter in any existing mobile groundwater in Mesaverde Formation rocks or as a consequence of re-entry drilling and testing. Quite possibly, groundwater in the Mesaverde Formation is immobile. In this case all radioactivity will reside where it was initially emplaced unless it is artificially removed, and will decay eventually to concentrations below 'Concentration Guides' levels. Any mobile water in the Mesaverde Formation which becomes contaminated with explosion nuclides, and is located below about 7000 feet is expected to move downward or laterally but not upward. Above 7000 feet any contaminated mobile waters are expected to move laterally. Hydrologic data indicate that the rate of movement of contaminated water will be essentially negligible. Very likely the rate of movement will be low enough and chemical-exchange retardation high enough to prevent transport of nuclides in greater-than-CG concentrations for any significant distances.
W71-01136

EXPERIMENTAL APPLICATION OF CHLOROPHOS FOR MOLLUSC CONTROL AT POND FARMS.
Bureau of Commercial Fisheries, Washington, D.C. Office of Foreign Fisheries (Translations). V. A. Musseliv, and V. I. Laptev.
Available from NTIS as PB-192 866T, \$3.00 in paper copy, \$0.95 in microfiche. Russian translations, March 1970. 6 p.
Identifiers: *Fishes, Industries, *Molluscids, Organic phosphorous compounds, Pest control, Insecticides, Tests, Dosage, USSR, Fisheries, *Trichlorfon, Phosphoric/acid/ (dimethyl-ester)- (1-hydroxy-2-2-trichloro)ethyl.

Tests with chlorophos (trichlorfon) were studied regarding its effectiveness in the control of gastropod molluscs; its residual effect on fish has not been studied at all. The experiments were conducted to clarify the optimal doses of the preparation as a molluscicide and its influence in test concentrations on fish, and to investigate methods of applying it.
W71-01140

CONTAINMENT OF OIL SPILLS BY PHYSICAL AND AIR BARRIERS,
Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab. David P. Hoult.
Available from NTIS as PB-192 629, \$3.00 in paper copy, \$0.95 in microfiche. 1970. 18 p, figs. FWPCA Project 15080-ESL.
Identifiers: *Water pollution, *Oils, *Booms, Water pollution, Theory, Mathematical analysis, *Oil pollution, Oil spills, *Water pollution control equipment, Stoppollution project.

A review of the state of the understanding of barriers to contain oil is presented. Using recent results, the main design parameters for a physical barrier in a steady current are presented. Included are discussions of draw down, forces, moments, and the configuration a boom takes on when deployed in a current. In each topic, comparison is made with experimental results and available theory. It is shown that a properly designed boom may hold large amounts of oil against a steady current. A brief discussion of the implications of these new results for air barriers is presented also.
W71-01141

PITTARD V SUMMEROUR (ENJOINING OF ALLEGED NUISANCE).
For primary bibliographic entry see Field 06E.
W71-01148

COMPREHENSIVE REPORT FOR THE ALASKA STATE HOUSING AUTHORITY, WATER AND SEWAGE SYSTEMS IN THE GREATER JUNEAU BOROUGH, ALASKA.
Alaska State Housing Authority, Anchorage.
For primary bibliographic entry see Field 06B.
W71-01156

ANALYSIS AND MODEL TESTS TO DETERMINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM.
Hydronautics Inc., Laurel, Md.
W. T. Lindenmuth, J. O. Scherer, and P. Van Dyke.
Available from NTIS as AD-702 513, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report 948-1 (11), January 1970, various pagings. DOT Contract DOT-CG-93907-A.
Identifiers: *Water pollution, Control systems, *Petroleum, Water pollution, *Floating bodies, Performance (Engineering), Motion, Mathematical analysis, Model tests, Programming (Computers), Resonant frequency, Mechanical properties, Water waves, Design, Cylindrical bodies, Force (Mechanics), *Oil retention booms, *Oil spills.

The document presents a theoretical analysis of the loads and motions of a continuous, elastic, oil retention boom of arbitrary configuration. The boom is subjected to loads of wind, current, and an irregular sea. The analytical method was programmed for an IBM 1130 computer and used to generate data for a variety of oil booms. Towing tank tests were conducted on selected boom configurations and serve to check the theoretical analysis.
W71-01172

COMPREHENSIVE WATER AND SEWER PLAN FOR BALDWIN COUNTY, ALABAMA.
South Alabama Regional Planning Commission, Mobile.
For primary bibliographic entry see Field 06B.
W71-01174

PROCEEDINGS OF THE CONFERENCE WATER RESOURCES RESEARCH - 1970.
Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 09A.
W71-01192

USE OF A CONTINUOUS STREAMFLOW SIMULATOR IN WATER RESOURCES DESIGN,
Pittsburgh Univ., Pa., and Pennsylvania Dept. of Forest and Waters, Harrisburg.
Rafael G. Quimpo, and Jan C. Phillips.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 83-90, 1969. 8 p, 1 fig, 6 ref. OWRR Grant No 14-01-0001-1590.

Field 05—WATER QUALITY MANAGEMENT AND PROTECTION

Group 5G—Water Quality Control

Descriptors: *Simulation analysis, *Stochastic processes, *Waste assimilative capacity, *Stream-flow forecasting, Analog models, Mathematical models, Statistical models, Design, Sewage treatment, Waste water disposal, Planning, Probability, Water resources development.
Identifiers: Water resources design.

To study efficient utilization of the dilution capability of a river and still maintain the quality of surface water resources, stochastic modeling of streamflow in design was investigated. The time variability of river discharges is expressed statistically and incorporated in an analog model to simulate the future variations of flows in the stream. The streamflow simulator is used to obtain a design configuration for a waste treatment plant. The dilution capacities of the simulated flows and assumed water quality standards determine the rate of waste release, thus imposing external constraints on the plant design. Using cost data for different waste treatment levels, the simulator is operated in conjunction with different combinations of treatment plant components to determine which combination results in the most efficient operation during a 70-day period of critical streamflow. (Knapp-USGS) W71-01210

BIOLOGICAL WASTE TREATMENT IN THE FAR NORTH,
Federal Water Quality Administration, College, Alaska. Alaska Water Lab.
For primary bibliographic entry see Field 05D.
W71-01262

MICROTRAINING AND DISINFECTION OF COMBINED SEWER OVERFLOWS,
Crane Co., King of Prussia, Pa. Cochrane Div.
For primary bibliographic entry see Field 05D.
W71-01263

COMBINED SEWER REGULATION AND MANAGEMENT.
American Public Works Association, Chicago, Ill. Research Foundation.

Available from NTIS as PB-195 676, \$0.95 in microfiche. Also for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402. SOD I67.13/4: 11022D-MO 08/70. Water Control Research Series 11022 DMU 08/70, July 1970, 134 p, 2 tab, 41 fig. FWQA Contract 14-12-456. FWQA Program 11022 DMU 08/70.

Descriptors: *Overflow, Regulation, Design, Operations, Maintenance, *Sewers, Water pollution control, Wastewater treatment.
Identifiers: *Combined sewers, system control, quantity of overflow, quantity of overflow, Tide gates, *Overflow regulation.

Design application, operation and maintenance of combined sewer overflow regulator facilities are detailed in this Manual of Practice, developed in conjunction with a report prepared on combined sewer overflow regulators. Design calculations are given for various types of regulators and tide gates. A sample regulator facility control program is given to illustrate the development of a control system. Operation and maintenance guidelines are also given. Thirty-eight sketches and photographs are included. (Sullivan-APWA Research Foundation) W71-01265

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
For primary bibliographic entry see Field 06B.
W71-01300

RESEARCH NEEDS IN THE CIVIL ENGINEERING ASPECTS OF POWER.

For primary bibliographic entry see Field 08C.
W71-01318

PENNSYLVANIA ERASES ITS MINING SCARS,
Ackenheil (A.C.) and Associates, Inc., Pittsburgh, Pa.
Alfred C. Ackenheil.
Civil Engineering, Vol 40, No 10, p 54-56, October 1970. 3 p, 1 fig, 3 photo.

Descriptors: *Mine drainage, *Mining, *Environmental effects, *Pollution abatement, *Pennsylvania, Land reclamation, Watershed management, Mine water, Land subsidence, Underground structures, Water pollution sources, Strip mines.
Identifiers: Chartiers Creek Watershed, Environmental damages, Restoration program, Operation Scarlift.

A \$200-million program to wipe out environmental damages left by a century of coal mining, particularly mine drainage pollution is underway in the Chartiers Creek Watershed. Known as Operation Scarlift, its main goals are: (1) to eliminate pollution from mine waters of 3,000 mi of Pennsylvania's 50,000 miles of streams and rivers; (2) to put out fires at abandoned mines; (3) to prevent surface cave-ins; and (4) to restore the 200,000 acres of abandoned surface mines to their original contour. The article focuses on the Chartiers Watershed, an important area near Pittsburgh, where drainage from abandoned surface and underground mines causes many problems. Details are given as to how the major sources of mine drainage were located and what is being done to plug up these sources permanently. (Lang-USGS) W71-01330

SAN FRANCISCO BAY-DELTA WATER QUALITY CONTROL PROGRAM.
Kaiser Engineers, Oakland, Calif.

Project supported in part by the Federal Water Pollution Control Administration. Final Report to California State Water Resources Control Board, Sacramento, June 1969. 545 p, 76 fig, 110 tab, 69 ref.

Descriptors: *Bays, *Deltas, *Estuaries, *Water quality control, *Water pollution control, *Waste water, *Drainage effects, Programs, *Planning, *Reclamation, *Oceans, California, Coliforms, Pesticides, Pesticide toxicity, Toxicity, Oceanography, Agricultural watersheds, Eutrophication, Urbanization, California.
Identifiers: *Waste water management, *San Francisco Bay, Ocean disposal, Sacramento River, San Joaquin River.

The San Francisco Bay-Delta Water Quality Control Program was authorized in 1965 when the California State Legislature passed the Water Pollution Control Law. The State Water Quality Board contracted with Kaiser Engineers to conduct a comprehensive study of the effects of waste water and drainage discharges into the Bay and Delta, and to develop the basic features of a comprehensive plan for the control of water pollution. After evaluating various management alternatives, the engineers recommended that a regional waste water management agency be formed promptly to plan, design, construct and operate a water pollution and quality control system throughout the twelve counties comprising the Bay-Delta area. The physical facilities recommended would encompass two key features: (1) transporting non-reclaimable waste materials to the sea, initially by discharge to that portion of the Bay where waters are rapidly exchanged with ocean waters, and later by actual conveyance to the ocean; and (2) maximum reclamation and reuse of waste waters as supplemental water supplies. The first phase of construction is recommended for completion 1980 and is estimated to cost \$750 million, in 1969 dollars. The major water quality problems were found

to be related to eutrophication, toxic effects of waste water discharges, persistent pesticides, and excessive concentrations of coliform bacteria. (Poertner) W71-01333

INSTREAM AERATORS FOR POLLUTED RIVERS,
Rutgers - The State Univ., New Brunswick, N.J. Water Resources Research Inst.
William Whipple, Francis P. Coughlan, and Shaw L. Yu.
Journal of Sanitary Engineering division, ASCE, Vol. 96, No. S55, Proc. Paper 7631, Oct. 1970, p. 1153-1165, 7 fig, 2 tab, 9 ref.

Descriptors: *Temperature, *Aeration, Oxygen demand, Systems analysis, Waste water treatment, Dissolved oxygen, Costs.
Identifiers: Deoxygenation coefficient, Transfer rate, Flow velocity, Polluted river, Aerators.

Field tests and performance analysis of instream aeration equipment on the Passaic River showed mechanical aerators were more efficient than diffusers. Transfer rates varied markedly with oxygen deficit, temperature, and velocity of flow. Unexpectedly, the rate of deoxygenation increased greatly downstream of the aerators. Cost estimates indicate that nine 75-hp mechanical aerators with a total rated capacity of 675 hp would have total annual costs of \$102,000 or \$151 per annual hp of rated capacity. Electric-drive diffuser aerators rated at 80 hp each would have total annual costs of \$141,400 or \$147 per annual hp of rated capacity. No injured fish were observed in two seasons of operation. A systems analysis, based upon the principle of BOD mass balance analysis, showed that aerators would achieve a given dissolved oxygen level at about one-fourth the cost of advanced waste treatment. Application should be considered for those streams where secondary waste treatment is not sufficient to achieved dissolved oxygen levels desired. (Upadhyaya-Vanderbilt) W71-01342

ECONOMICS OF WATER QUALITY: AN APPLICATION TO THE DES MOINES RIVER BASIN.
Iowa Univ., Iowa City. Dept. of Economics.
For primary bibliographic entry see Field 06B.
W71-01353

THE COST OF IMPROVING WATER QUALITY IN THE GREAT LAKES,
State Univ. of New York, Syracuse. Water Resource Center.
For primary bibliographic entry see Field 06C.
W71-01354

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,
Minnesota Univ., Minneapolis. Water Resources Research Center.
For primary bibliographic entry see Field 06B.
W71-01358

QUALITY OF STORMWATER DRAINAGE FROM URBAN LAND AREAS IN NORTH CAROLINA.
North Carolina Water Resources Research Inst., Raleigh.
Edward H. Bryan.
Available from NTIS as PB 195 781, \$3.00 in paper copy, \$0.95 in microfiche. North Carolina Water Resources Research Institute Report No. 37, June 1970. 43 p. OWRR Project A-034-NC (2).

Descriptors: Storm runoff, Surface runoff, Water quality control, *North Carolina, Water quality, Drainage, Urbanization, *Surface drainage.
Identifiers: Urban land runoff, *Durham (North Carolina), *Storm water.

Techniques of Planning—Group 6A

The objective of this project was to determine the quality characteristics of stormwater draining from an urban land drainage basin in North Carolina as influenced by the nature of land use on the basin. A number of areas in North Carolina and elsewhere are confronted with the need to require high degrees of water quality management. Urbanization of a region has an effect on the quality of its stormwater. The purpose of this study was to determine quantitative relationships between different land-use patterns and consequent differences in the water quality. The drainage basin selected has an area of 1.67 square miles and is in the upper portion of the Cape River Basin of North Carolina. Residential, commercial and industrial activities on the selected basin are representative of the urban land-use pattern in North Carolina cities and towns. During the first year a gaging and sampling station was installed on the outlet of the major basin. Sampling and analyses were initiated to characterize the quality of water draining from the basin and its two major constituent basins. In the second year, the major basin was divided into a number of subsidiary basins to characterize the quality of water draining from each sub-basin and attempt correlation of its qualities with land use. Urban stormwater was found to be a significant source of pollutional constituents to receiving streams. With respect to BOD, the total weight contribution by stormwater from this basin was estimated to equal that of its sanitary wastewater effluent from secondary treatment. The contribution of total organic matter as measured by chemical oxygen demand in its stormwater was greater than that attributable to discharge of raw sanitary wastewater from a strictly residential, average urban area. The total solids contribution by urban stormwater was substantially larger than would be expected from average raw domestic wastewater. The contribution of phosphate from this urban basin was nominal for urban stormwater in comparison with that of domestic wastewater. (Howells-North Carolina)
W71-01360

RESTORATION OF LOST AND DEGRADED HABITATS,
Smithsonian Institution, Washington, D.C.
For primary bibliographic entry see Field 06G.
W71-01367

UTILITIES: NEW TECHNIQUES, AND THEIR APPLICATION TO THE MUSKEGON COUNTY AREA, A WORKING PAPER REPORT.
Sheafer (John R.) and Associates, Wheaton, Ill.
For primary bibliographic entry see Field 05D.
W71-01372

MOUNDSVILLE WATER CO V MOUNDSVILLE SAND CO (TRESPASSER'S LIABILITY FOR DAMAGE TO WATER SUPPLY LINE).
For primary bibliographic entry see Field 06E.
W71-01431

THE SS NEA HELLIS (FINES FOR DISCHARGING OIL INTO NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-01450

UNITED STATES V THE DELVALLE (UNINTENTIONAL WATER POLLUTION BY UNUSED FUEL OIL).
For primary bibliographic entry see Field 06E.
W71-01454

ANALYSIS AND MODEL TESTS TO DETERMINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM,
Hydronautics, Inc., Laurel, Md.
For primary bibliographic entry see Field 08B.
W71-01527

CONTAINMENT AND COLLECTION DEVICES FOR OIL SLICKS,
Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
David P. Hoult.
Available from NTIS as PB-190 377, \$3.00 in paper copy, \$0.95 in microfiche. Publication No 69-8, August 1969. 15 p, 7 fig, 5 ref.
Identifiers: *Oil slicks, *Oil pollution, Oil spills, *Oils, *Films, *Collecting methods, *Water pollution, *Booms, Pneumatic devices, Oceans, Containment, Performance (Engineering), Baffles, Compressed air, Buoyancy.

The main engineering features of physical and pneumatic booms operating as oil containment devices in the open sea are discussed. The oil containing capacity of a pneumatic boom is limited by the power available to compress the air. It is suggested that the containment capacity of physical booms is limited by the effective depth of the boom. The results of preliminary experiments are used to establish these ideas. A brief review of the main types of collection systems in use is given.
W71-01528

WASTE MANAGEMENT CONCEPTS FOR THE COASTAL ZONE, REQUIREMENTS FOR RESEARCH AND INVESTIGATION.
National Academy of Sciences-National Research Council, Washington, D.C. Committee on Oceanography.

Available from Printing and Publishing Office National Academy of Sciences, 2101 Constitution Ave. NW, Wash, DC 20418, PC \$3.50. Microfiche available from NTIS as PB-195 861, \$0.95. National Academy of Sciences - National Academy of Engineering, Washington, DC, 1970. 126 p, 15 tab, 2 fig, 286 ref, 4 append. FWQA Program 16070 DUF.

Descriptors: *Waste disposal, *Coasts monitoring, Hydrodynamics, Chemical reactions, Ecology.
Identifiers: *Waste management, *Coastal zone, *Research priorities, Physical process, Biological effects, Ecological impacts.

The scientific and engineering requirements were evaluated for research related to coastal wastes management based upon 16 background papers in 4 fields: monitoring, physical effects, chemical effects, chemical and biological effects. The focus is on recommended research subjects in each of these fields, ranked as to priority, and accompanied with estimates of minimum effort required including completion time. Research required to implement the monitoring plan includes: uniform sampling procedures and quantitation of: (1) floatable matter, (2) films, (3) persistent pesticides, (4) persistent organics, (5) heavy metals, (6) acute toxicity, (7) biostimulants, (8) biomass, and (9) community-structure productivity. Research problems in physical process comprise: interactions including dilution and diffuser design, physical processes in estuaries and coastal areas, turbulent flux, decay of nonconservative substances, interactions between floatable and settleable components of wastes. Recommended areas of research in chemical factors include: trace metals, complexing, inorganic and organic aggregation, diagenesis, nutrient fluxes, organic matter distribution, phytoplankton blooms, anoxic conditions, biochemical concentrations, sublethal effects, oil spillage, synthetic organics, and human physical activities. Recommended research on biological effects include: effects of outfall areas, health significance of wastes, biological concentration, DDT, biological communities, tolerance limits for major uses, improvement of systems and models, criteria for review of proposals for ecological study requirements, and evaluation of new waste products.
W71-01544

WATER LAW'S DOUBLE ENVIRONMENT: HOW WATER LAW DOCTRINES IMPEDE THE

ATTAINMENT OF ENVIRONMENTAL ENHANCEMENT GOALS,
For primary bibliographic entry see Field 06E.
W71-01547

WATER LAW IN SOUTHEASTERN WISCONSIN.
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01549

WATER LAW IN SOUTHEASTERN WISCONSIN (WATERSHED MANAGEMENT AND POLLUTION CONTROL).
Wisconsin Univ., Madison.
For primary bibliographic entry see Field 06E.
W71-01551

WATERS-POLLUTION-DISCHARGE LICENSE.
For primary bibliographic entry see Field 06E.
W71-01555

OIL DISCHARGE PREVENTION AND POLLUTION CONTROL.
For primary bibliographic entry see Field 06E.
W71-01556

AN ACT RELATING TO WATER QUALITY STANDARDS.
For primary bibliographic entry see Field 06E.
W71-01558

LET THE POLLUTER BEWARE (LEGAL RAMIFICATIONS OF POLLUTION),
For primary bibliographic entry see Field 06E.
W71-01562

REGULATION OF POLLUTION BY MINE WASTES.
For primary bibliographic entry see Field 06E.
W71-01570

I. COMPREHENSIVE PLAN FOR THE FOX RIVER WATERSHED, CH 14 (SURVEY OF LEGAL ASPECTS OF WATERSHED DEVELOPMENT).
For primary bibliographic entry see Field 06E.
W71-01578

UNITED STATES V CARROLL OIL TERMINALS, INC (ACCIDENTAL OIL LEAKAGE CAUSED BY STORM DAMAGE).
For primary bibliographic entry see Field 06E.
W71-01595

PUBLIC SERV COMM'N V SINKING SPRING WATER CO (REQUIRING POTABLE WATER FROM SUPPLIER).
For primary bibliographic entry see Field 06E.
W71-01602

06. WATER RESOURCES PLANNING

6A. Techniques of Planning

USE OF STOCHASTIC HYDROLOGY TO DETERMINE STORAGE REQUIREMENTS FOR RESERVOIRS - A CRITICAL ANALYSIS,
Stanford Univ., Calif. Program in Engineering Economic Planning.
Stephen J. Burges.
Available from NTIS as PB-195 691, \$3.00 in paper copy, \$0.95 in microfiche. Project on Engineering-Economic Planning, Report EEP-34, September 1970. 208 p, 27 tab, 56 fig, 68 ref. OWRP Project C-1635 (No 3150) (1).

Field 06—WATER RESOURCES PLANNING

Group 6A—Techniques of Planning

Descriptors: *Synthetic hydrology, *Monte Carlo method, *Draft-storage curves, *Reliability, *Correlation analysis, Analytical techniques, Hydrologic data, Markov processes, Mass curves, Mathematical models, Regression analysis, Sequential generation, Statistical methods, Variability, Stochastic processes.

A study was conducted to locate areas of uncertainty when Markov runoff generation models are used in storage reservoir studies. A thorough examination of the basic method was made. The length of available record is critical to model parameter determination. Examination of the Monte Carlo generation technique showed that, for annual models and economic lives in the range 20 to 100 years, at least 1000 generated inflow traces are required to accurately define the distribution of storage to meet a specified demand. Storage is described by the extreme value type 1 probability distribution. Factors critical to storage requirements are the coefficient of variation and correlation of the inflow sequence, demand pattern and economic life. Except in the special case, where runoff is highly seasonal and the bulk of the demand occurs after the main runoff period, monthly generation models were found to be necessary. When a log-normal model is used, a method that preserves the properties of the observed sequence is necessary. Multiple-lag generation models were shown to be unjustified. Correlations in observed data at increasing lag result from short records. W71-01188

FORECASTING DEMAND FOR URBAN WATER SUPPLY,
Stanford Univ., Calif. Program in Engineering Economic Planning.
For primary bibliographic entry see Field 06D.
W71-01189

USE OF A CONTINUOUS STREAMFLOW SIMULATOR IN WATER RESOURCES DESIGN,
Pittsburgh Univ., Pa., and Pennsylvania Dept. of Forest and Waters, Harrisburg.
For primary bibliographic entry see Field 05G.
W71-01210

ALLUVIAL RIVER BEHAVIOR - A FEW ASPECTS OF ITS SIMULATION IN A MODEL,
For primary bibliographic entry see Field 08B.
W71-01211

COMPUTER SIMULATION OF RIVERBED DEGRADATION AND AGGRADATION BY THE METHOD OF CHARACTERISTICS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 02E.
W71-01212

DATA-REVERSIBLE SYSTEMS FOR FLOOD ROUTING,
Technische Hogeschool, Delft (Netherlands). M. B. Abbott, and F. H. Verhoog.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 305-312, 1969. 8 p, 7 fig, 4 ref.

Descriptors: *Mathematical models, *Flood routing, Routing, Flood forecasting, Water management (Applied), River forecasting, Model studies.
Identifiers: Data-reversible mathematical models.

Reasons are given for introducing a data-reversible system for flood prediction. A particular data-reversible system is described and its special features and difficulties are outlined using examples. The construction of such a system necessitates the close interplay of several disciplines: surveying (field-interpretation) technique, hydraulics, partial differential equations, (existence theorems for a

proper posing of problems), numerical analysis, and the theory of algorithms. (Knapp-USGS)
W71-01213

SIMULATION TECHNIQUES IN WATER RESOURCES SYSTEMS,
State Hydraulic Works, (Turkey). Dept. of Research.
For primary bibliographic entry see Field 02E.
W71-01215

MODELTESTS INVESTIGATING THE POSSIBILITIES OF ARTIFICIAL WATER STORAGE IN ALLUVIAL GROUNDS,
Stuttgart Univ., (West Germany).
For primary bibliographic entry see Field 04B.
W71-01216

ELECTRONIC ANALOGUES REPRESENTING NONLINEAR FLOW THROUGH OPEN CHANNELS AND FLOOD CONTROL STRUCTURES,
Central Water and Power Research Station, Poona (India).
For primary bibliographic entry see Field 08B.
W71-01217

EVALUATION OF SIMULATION MODELS FOR RIVER RUNOFF THROUGH NYQUIST PLOTS,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
Isao Yamaoka, and Mutsuhiro Fujita.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 171-180, 1969. 10 p, 14 fig, 1 tab, 4 ref.

Descriptors: *Simulation analysis, *Synthetic hydrology, *Streamflow forecasting, *Runoff forecasting, Hydrograph analysis, Hyetographs, Analog computers, Analog models, Mathematical models, Frequency analysis, Model studies.
Identifiers: Japan, Graphic procedures, Nyquist plots.

An application of the frequency-domain technique uses Nyquist plots for the evaluation or selection of simulation models for river runoff forecasting. In a river runoff system, the frequency-domain transfer function G may be defined as the ratio of the complex output function due to the riverflow hydrograph to the complex input function due to the hyetograph. The real and imaginary parts of G may easily be calculated by use of analog-computers. Nyquist diagrams, which are vector loci or polar plots for G , may ideally be used for the evaluation of mathematical models by comparison of the Nyquist plot with the observed hydrologic data. Some elementary examples are used as illustration at three stations in Hokkaido, Japan. (Knapp-USGS)
W71-01218

SIMULATION FOR THE EFFECTIVE DISTRIBUTION OF WATER RESOURCES,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
Nobumasa Kasugaya.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 9-16, 1969. 8 p, 2 fig, 6 tab.

Descriptors: *Computer programs, *Planning, *Simulation analysis, *Water management (Applied), Mathematical models, Optimization, Systems analysis, Municipal water, Irrigation water, Industrial water, Water demand, Cost-benefit analysis.
Identifiers: Water resources management.

Computer simulation may be used for appropriate distribution of water resources, using quantitative estimation of the relation between water resources and water demands, as well as cost effectiveness. A general model is based on a planning, programming, and budgeting system, and basic data for priority allocation of investments are used to forecast additional needs for water. A particular municipality was studied for illustrative calculations. In this case, the additional needs are for agricultural water, industrial water and utility service water, and the result of calculations indicates that industrial water should be given priority. (Knapp-USGS)
W71-01219

THE ROLE OF SYSTEMS SIMULATION IN WATER RESOURCE DEVELOPMENT,
Purdue Univ., Lafayette, Ind. School of Civil Engineering.
G. H. Toebes.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 447-455, 1969. 9 p, 5 fig.

Descriptors: *Systems analysis, *Simulation analysis, *Water resources development, Hydrology, Optimization, Linear programming, Dynamic programming, Digital computers, Computer programs, Cost-benefit analysis.
Identifiers: Systems simulation.

The use of methods of systems analysis in water resources studies is outlined and evaluated. In pursuing answers to questions of the value of these methods, some characteristics of water resource systems, systems simulation, systems analysis and systems synthesis are discussed. It is concluded that numerical system simulation is an ultimate use of many hydraulic research results; that simulation should be seen in the perspective of systems analysis; that systems analysis can yield priorities for hydraulic research; that knowledge of such priorities will yield improved systems synthesis; and that such syntheses will increase the relevance and use of simulation techniques in water resource development questions. (Knapp-USGS)
W71-01220

ACCURACY OF THE NUMERICAL SOLUTION FOR GENERAL UNSTEADY RIVER FLOW EQUATION,
For primary bibliographic entry see Field 02E.
W71-01223

A MATHEMATICAL MODEL OF UNSTEADY FLOW IN A NATURAL OR ARTIFICIAL WATER COURSE,
Vattenbyggnadsbyran, Stockholm (Sweden).
For primary bibliographic entry see Field 02E.
W71-01224

AMPLITUDE-DISSIPATIVE AND PHASE-DISSIPATIVE SCHEMES FOR HYDRAULIC JUMP STIMULATION,
Technische Hogeschool, Delft (Netherlands).
For primary bibliographic entry see Field 08B.
W71-01225

THE CALCULATION OF FLOOD HYDROGRAPHS IN SOME RIVER SYSTEMS IN GERMANY,
Technische Hochschule, Brunswick (West Germany).
For primary bibliographic entry see Field 02E.
W71-01226

EXPERIENCE WITH THE MATHEMATICAL MODEL OF THE HYDRAULIC NETWORK OF RIJNLAND WATER BOARD,
Waterloopkundig Laboratorium, Delft (Netherlands).

D. R. A. Stapel, and M. de Vries.

French summary included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 395-403, 1969. 9 p, 4 fig, 3 ref.

Descriptors: *Mathematical models, *Water management (Applied), Drainage systems, Land reclamation, Pumping, Urbanization, Water control, Drainage practices, Drainage engineering, Canals.

Identifiers: The Netherlands.

The various problems related to the water-management of Rijnland Water Board have led to the application of a mathematical model of the main irrigation - and drainage-system. After some general information about the setup of the mathematical model, some examples are given, demonstrating the use of the model for the solution of practical problems. About 40 sq km of Rijnland consist of lakes and many kilometers of canals, all in open connection with each other. The area has been split up in about 200 polders, but the water courses of these polders are not in open connection with the main network; pumping stations discharge the water from the polders into the network of Rijnland Water Board. The mathematical model contains the main branches of the network of Rijnland. Minor parts are neglected unless local problems of the network have to be studied in which those minor parts are important. (Knapp-USGS)

W71-01227

MATHEMATICAL MODELLING ON DIGITAL COMPUTERS AND CALCULATIONS FOR MULTI-PURPOSE UTILIZATION OF STREAM-FLOW,

A. Sh. Resnikovskiy.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 405-411, 1969. 7 p, 11 ref.

Descriptors: *Water management (Applied), *Optimization, *Streamflow forecasting, *Water resources development, Simulation analysis, Synthetic hydrology, Reservoir design, Hydroelectric plants, Hydroelectric power, Planning, Monte Carlo method, Stochastic processes, Water utilization.

Identifiers: USSR.

In the Soviet Union digital computers are used in optimization and modeling for the design and operation of large water resource systems and power grids having hydropower plants with large-capacity reservoirs. Results are presented of the spectral analysis of a series of observations on the streamflow of some large rivers. Methods are developed for generation of simulated streamflow for lognormal and gamma distributions on digital computers by means of Monte Carlo techniques. Cases are cited where simulated streamflow is used in the design and operation of multipurpose hydroelectric projects with long-term storages. (Knapp-USGS)

W71-01228

FLOOD FORECAST AND FLOOD CONTROL BY COMPUTER,

Ministry of Construction, Morioka (Japan).

For primary bibliographic entry see Field 04A.

W71-01229

THE ANALYSIS OF UNSTEADY FLOW IN RIVERS BY AN ANALOGUE COMPUTER,

Public Works Research Inst. Tokyo (Japan).

For primary bibliographic entry see Field 07C.

W71-01230

AN ANALYSIS OF RUNOFF MODELS,

Nagoya Univ. (Japan). Dept. of Civil Engineering.

For primary bibliographic entry see Field 02A.

W71-01232

A STOCHASTIC MODEL TO SIMULATE MONTHLY RIVER FLOW SEQUENCES,

Osaka Univ. (Japan). Hydraulics Lab.

For primary bibliographic entry see Field 04A.

W71-01233

INDIRECT DETERMINATION OF SYNTHETIC RUNOFF,

Agricultural Research Service, Chickasha, Okla. Soil and Water Conservation Research Div.

For primary bibliographic entry see Field 02A.

W71-01235

MATHEMATICAL MODEL OF THE BIG BEND WELL FIELD,

Southwestern Ohio Water Co., Cincinnati; and Cincinnati Univ., Ohio. Dept. of Civil Engineering.

For primary bibliographic entry see Field 02F.

W71-01236

EXPERIMENTAL AND THEORETICAL MODELING OF SALINE WEDGES,

Tokyo Inst. of Tech. (Japan). Dept. of Civil Engineering.

For primary bibliographic entry see Field 02L.

W71-01239

SOME PRACTICAL ASPECTS OF TIDAL COMPUTATIONS,

Delta Project, The Hague (Netherlands). Hydraulics Dept.

For primary bibliographic entry see Field 02L.

W71-01241

A COMPUTER SIMULATION STUDY OF TRAVELTIMES OF INJECTED PARTICLES AND TIDE-WAVES IN WELL-MIXED ESTUARIES,

Geological Survey, Washington, D.C. Water Resources Div.

For primary bibliographic entry see Field 02L.

W71-01252

CROSS-SECTIONAL TIME SCALES AND DISPERSION IN ESTUARIES,

California Univ., Berkeley, Calif. Dept. of Civil Engineering.

For primary bibliographic entry see Field 02L.

W71-01254

DESIGN OF WATER QUALITY SURVEILLANCE SYSTEMS - PHASE I - SYSTEMS ANALYSIS FRAMEWORK,

NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.

For primary bibliographic entry see Field 05A.

W71-01264

IBP DESERT RESEARCH UNDERWAY,

Sharon Friedman.

Funded by the National Science Foundation. Bioscience, Vol 20, No 18, 15 September 1970. 6 fig.

Descriptors: *Arid lands, *On-site data collections, *Ecosystems, *Computer models, *Data storage and retrieval, Aquatic environment, Aquatic populations, Aquatic productivity, Utah, New Mexico, Arizona, Idaho, Ecology, Xerophilic animals, Xerophytes, Microorganisms, Terrestrial habitats, Deserts, Energy transfer, Productivity, Nutrients, Playas, Salinity, Soil surveys, Biomass, Fire, Chem-control, Water resources, Biological properties. Identifiers: *Validation studies, *International Biological Program (IBP), *Nutrient cycling, *Desert aquatic ecosystems, Overgrazing, Desert biome.

This is a description of the U.S. desert biome study which is part of the International Biological Pro-

gram (IBP). The intent of the study is to develop methods of forecasting arid area responses to changes of all sorts, both natural and man-made. Productivity, nutrient cycling, energy flow and other desert ecosystem characteristics will be studied in both terrestrial and aquatic situations. Three major types of research are now being conducted: (1) Modeling and data bank constructs, (2) validation studies and (3) process studies. A computer model will use as a starting point a simplified ecosystem involving soil, plants and herbivores. Validation studies, serving as checks on the computer models, are currently underway on aquatic ecosystems in New Mexico, Idaho and Utah, and on 2 terrestrial systems in Arizona. The terrestrial work includes studies on plant and animal species biomass, populations and their age distributions and the impacts of fire, chemical control and overgrazing on desert plants and microorganisms. Aquatic studies will involve both playa water variations and their resulting effects on plant and animal life and other desert freshwater and saline situations. The process studies will provide specific biological data on important plant and animal species in Arizona and Idaho. (Casey-Arizona)

W71-01284

A COMPARISON OF SOME DYNAMIC, LINEAR AND POLICY ITERATION METHODS FOR RESERVOIR OPERATION,

Cornell Univ., Ithaca, N. Y.

D. P. Loucks, and L. M. Falkson.

Water Resources Bulletin, Vol 6, No 3, p 384-400, May-June 1970. 17 p, 3 fig, 2 tab, 10 ref.

Descriptors: *Reservoir operation, Multiple-purpose reservoirs, Markov processes, Losses, Benefits, Optimization, *Mathematical models, *Linear programming, *Dynamic programming, Stochastic processes, Mathematical analysis, Computer programming, Project planning, Algorithm, Hydrology.

Identifiers: Operating criteria, Stochastic models, *Iteration method, Comparative studies, Markov chain, Markov model, Computer applications.

Three mathematical modeling and solution techniques--dynamic programming, policy iteration, and linear programming--used to derive alternative sequential operating policies for multiple-purpose reservoirs are reviewed and compared. Flows into the reservoir are assumed to be serially correlated stochastic quantities. The reservoir capacity and the storage and release targets, if any, are predetermined. The models are discrete because the continuous variables of time, volume, and flow are approximated by discrete units. The problem is to derive an optimal operating policy. Such a policy defines the reservoir release as a function of the current storage volume and inflow. The form of the solution and some advantages, limitations, and computational efficiencies of each of the models and their algorithms are compared using a simplified numerical example. Each model type yielded identical policies, but computational efficiencies differed. For relatively small problems requiring up to about 1000 constraints, total cost in man-hours and computer time favored linear programming methods. Larger problems were more adapted to dynamic programming and policy iteration techniques. (USBR)

W71-01315

SYSTEMS STUDIES OF DDT TRANSPORT,

Wisconsin Univ., Madison. Dept. of Engineering; and American Trial Lawyers Association.

H. L. Harrison, O. L. Loucks, J. W. Mitchell, D. F.

Parkhurst, and C. R. Tracy.

Science, Vol 170, No 3957, p 503-508, October 30, 1970. 6 p, 2 fig, 27 ref.

Descriptors: *DDT, *Pesticide residues, Systems analysis, Ecosystems, Model studies, Trophic level, Biorhythms, Balance of nature, Pesticide toxicity, Mathematical models, Environmental effects, Distribution patterns.

Field 06—WATER RESOURCES PLANNING

Group 6A—Techniques of Planning

Identifiers: *DDT transport mechanism, Biosphere pollution, Population response.

A systems analysis that predicts long-term impacts of DDT in ecosystems is described. The transport mechanisms of DDT, its chemical properties, its physiological effects on individual organisms, and its effects on whole populations are explained. A mechanistic model is developed to demonstrate the movement of DDT and its breakdown product DDE in an inland ecosystem. If no more DDT is added to the biosphere, its concentration in certain species at or near the top of the trophic structure could continue to rise for several years. Within the broad range of DDT and DDE toxicity, additional species may decline or disappear. At any trophic level there can be three major consequences: (1) DDT concentration may kill the members at that level, in which case the entire ecosystem will move toward a new equilibrium; (2) the concentration may not be lethal but cause reproductive failure and eventual trophic level disappearance; and (3) the concentration may have no apparent effect but the DDT will pass on to the next higher trophic level, which will be subject to the same fate of concentration. (Lang-USGS)
W71-01328

MANITOBA HYDRO CHURCHILL RIVER DIVERSION, STUDY OF ALTERNATIVE DIVERSIONS, A MATHEMATICAL MODEL.
Underwood, McLellan and Associates Ltd., Winnipeg (Manitoba).
For primary bibliographic entry see Field 04A.
W71-01338

OPERATIONS RESEARCH STUDY OF WATER RESOURCES PART I: METHODOLOGY AND PROBLEMS IN AN URBANIZED ARID ENVIRONMENT.
Arizona Univ., Tucson. Dept. of Hydrology.
Chester C. Kiesel, and Lucien Duckstein.
Water Resources Bulletin, Vol 6, No 5, October 1970, p 737-745. 1 fig, 24 ref.

Descriptors: *Water resources, *Methodology, *Operations research, *Decision making, Cities, Arid lands.
Identifiers: *Water resource management, *Urban environment.

The methodology of operations research is judged in relation to its utility to water resource management in an urbanized arid environment and to the study of worth of data for such management. Conditions for existence of a managerial problem are reviewed as is the multilevel structure of the decision process, including decisions on social goals for Western water use. Worth of data can only be judged in relation to a particular use to meet a social or managerial objective. The role of data uncertainty on the decision process is reviewed in the light of past water decisions and present and future problems. (Davis-Chicago)
W71-01364

SIMULATION/OPTIMIZATION TECHNIQUES FOR MULTI-BASIN WATER RESOURCE PLANNING.
Water Resources Engineers, Inc. Walnut Creek, Calif.
Donald E. Evenson, and Joe C. Moseley.
Water Resources Bulletin, Vol 6, No 5, October 1970, p 725-736. 3 fig, 1 tab, 9 ref.

Descriptors: *Analytic techniques, *Simulation, *Optimization, *Water resources, *Planning, Model studies, Mathematical models, Networks, Water resources development.
Identifiers: *Multi-Basin water resources planning.

A set of simulation and optimization tools capable of analyzing the development and operation of a complex, multi-basin, interconnected water resource are explained. These models provide valuable information regarding the important

questions: (1) 'When should new projects be built' (2) 'How big should they be' and (3) 'How should the system be operated'. Since these tools were developed by and for practicing engineers, their applicability to real-world problems is mandatory. To assure this, testing was done on an actual proposed project, the Texas Water System. Three basic models were developed. A simulation procedure, employing a direct solution of a set of linear equations, and an optimization program are used to describe the hydraulic behavior and compute the incurred costs. A network flow code, the Out-of-Kilter Algorithm, is used in an optimization model to determine the best reservoir operating rules and the least cost flow routing. Finally, a State Development Model incorporates response surface exploration using random sampling and the method of successive perturbations to select the development plan having the least overall present value. (Davis-Chicago)
W71-01365

6B. Evaluation Process

GEOLOGY FOR PLANNING AT CRESCENT CITY, ILLINOIS.
Illinois State Geological Survey, Urbana.
For primary bibliographic entry see Field 03D.
W71-01111

COMPREHENSIVE REPORT FOR THE ALASKA STATE HOUSING AUTHORITY, WATER AND SEWAGE SYSTEMS IN THE GREATER JUNEAU BOROUGH, ALASKA.
Alaska State Housing Authority, Anchorage.

Available from NTIS as PB-189 131, \$3.00 in paper copy, \$0.95 in microfiche. PORTIONS OF THIS DOCUMENT ARE NOT FULLY LEGIBLE. May 1, 1969. 132 p.
Identifiers: *Urban planning, *Alaska, *Sanitary engineering, Urban planning, Reviews, Population, Housing, Water supplies, Costs, Sewage, Sanitary engineering, *Juneau (Alaska).

The report is divided into five parts. Previous reports and studies that have been made in this area. Data pertaining to the existing water systems in the study area, present water supply requirements and future requirements; a preliminary design is made for a water distribution and storage system; cost estimates have been prepared for all recommended improvements. Data pertaining to the volume and characteristics of sewage from the major existing sewage systems. A brief discussion of financing including federal funds that may be available. An engineering design and construction program.
W71-01156

OPPORTUNITIES FOR DEVELOPMENT OF RIVER PORTS ON THE ARKANSAS RIVER WATERWAY SYSTEM.
Garver and Garver, Little Rock, Ark.

Available from NTIS as PB-191 203, \$3.00 in paper copy, \$0.95 in microfiche. April 1970, 126 p.
Identifiers: *Urban planning, *Arkansas, *Management planning, *Oklahoma, *Inland waterways, Harbors, *Harbors, Site selection, Industrial plants, Commerce, Economics, Transportation, *Arkansas River waterway system, *Marine terminals, *River basin development, *Area planning and development, *Arkansas River.

The considerations entering into the findings reported include: (1) Analyses of the population and economy of the River region; (2) a review of recent industrial development and current planning for the acquisition of new industry; (3) local transportation facilities as related to potential port sites; (4) an evaluation of sites suitable for port and industrial development; and (5) estimates of development costs. An extensive Appendix, included as a part of this report, contains data of value to organizations interested in river port and industrial development,

including: (1) Criteria for site selection; (2) measures for preserving sites suitable for development; (3) the use of air and water pollution and physical blight controls; (4) various methods of financing, including Federal assistance programs; and (5) procedures for attracting industry to port-related sites.
W71-01166

THE NATION'S ENGINEERING RESEARCH NEEDS, 1965-1985.
Engineers Joint Council, New York.

Available from NTIS as PB-189 275, \$3.00 in paper copy, \$0.95 in microfiche. May 26, 1962. 211 p.

Descriptors:
Identifiers: *Research program administration, Engineering, *Scientific research, Predictions, Natural resources, Energy, Environment, Transportation, Medicine, Education, Data processing systems, Bionics, Organizations, Management planning, Research and development, Developing.

Science is the predominant factor that influences the allocation of national research and development funds. The large federal programs of research and development are largely dedicated to the exploitation of new scientific opportunities. In the DOD and NASA budgets for research and development, major attention is given to devices that go deeper or higher or faster or farther or more accurately. The needs of people and society are not given sufficient attention in the allocation of research and development funds. The non-defense agencies do not have research and development programs that relate broadly to their entire mission or that reflect the enormous impact of technology on the lives of people and on political and social organizations. The importance on maintaining a competitive technological position to contribute to growth of the national economy is not recognized in the current allocations for research and development. The fragmentation of most industries has led to concentration on materials and devices with little relationship to the technical and socioeconomic systems within which these materials and devices must function.
W71-01169

COMPREHENSIVE WATER AND SEWER PLAN FOR BALDWIN COUNTY, ALABAMA.
South Alabama Regional Planning Commission, Mobile.

Available from NTIS as PB-190 528, \$3.00 in paper copy, \$0.95 in microfiche. South Alabama Regional Planning Comm. November 1969, 210 p.
Identifiers: *Sanitary engineering, *Alabama, *Water supplies, Management planning, Standards, Urban areas, Rural areas, Water wells, Storage, Sewage, Storms, Water pollution, Drainage, Statistical data, Budgets, Reviews, *Baldwin County (Alabama), *Regional planning, Storm sewers.

The comprehensive water and sewer plan for Baldwin County, Alabama, is an inventory, adequacy analysis, short range development program and water and sewer development plan for the water, sanitary sewers, and storm sewers in the county.
W71-01174

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME I. CHAPTERS I THROUGH III.
Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-189 410, \$3.00 in paper copy, \$0.95 in microfiche. February 1970, 388 p. PLLRC Study Report No 10.
Identifiers: *Management planning, Natural resources, *Economics, *Law, Organizations, Classification, United States government, Water sup-

plies, Forestry, Recreation, Mammals, Soils, Minerals, Roads, Decision making, Land use planning, Regional planning and development, *Public land.

Contents: Summaries of Public Land Law Review Commission study areas; Relation of resource use to land use planning and regional development; Land use planning in the Forest Service. (See also W71-01179 thru W71-01181)
W71-01178

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME II. CHAPTERS IV THROUGH XI.

Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-189 411, \$3.00 in paper copy, \$0.95 in microfiche. February 1970, 415 p. PLLRC Study Report No 10.

Identifiers: *Management planning, Natural resources, *Economics, *Law, Organizations, Classification, United States government, Water supplies, Decision making, Recreation, Forestry, Minerals, Agriculture, Mammals, Soils, Land use planning, Regional planning and development, Watersheds, *Public land.

Contents: Regional and local land use planning in the Bureau of Land Management; Land use planning in the National Park Service; Land use planning in the Bureau of Sport Fisheries and Wildlife; Land use planning and the Federal Water Development Project Agencies; Land use planning in the Department of Defense and the Atomic Energy Commission; Land use planning by state and local governments, and user groups. (See also W71-01178)
W71-01179

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME III. APPENDICES I THROUGH IV.

Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-189 412, \$3.00 in paper copy, \$0.95 in microfiche. February 1970, 339 p. PLLRC Study Report No 10.

Identifiers: *Management planning, Natural resources, *Economics, *Law, Organizations, Classification, United States government, Water supplies, Trees, Recreation, Roads, Budgets, Impact, Land use planning, Regional planning and development, *Public land.

Contents: Study methodology. The applicability of state and local land use regulation to federal lands and federal regulations to privately owned lands within the states; Appendix - Land use planning in the Forest Service; Appendix - Land use planning in the Bureau of Land Management. (See also W71-01178)
W71-01180

PROCEEDINGS OF THE CONFERENCE WATER RESOURCES RESEARCH - 1970.

Connecticut Univ., Storrs. Inst. of Water Resources.
For primary bibliographic entry see Field 09A.
W71-01192

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,

Minnesota Univ., Minneapolis. School of Public Health.
Ulric P. M. Gibson.
Ph D Thesis, Univ. of Minnesota, June 1970. 376 p, 14 tab, 53 fig, 112 ref. OWRR Project A-018-MINN.

Descriptors: *Water resources development, *Water quality, Planning, *Management, *Legisla-

tion, Minnesota, Effluents, Withdrawals, Urbanization, *Utilization, Mathematical models, Networks, Mississippi River Basin, Costs.
Identifiers: Effluent changes, In-stream water use.

The integration of water quality management into total water resources management is generally applicable to highly developed, densely populated areas. Management must be concerned not only with the quantitative aspects but simultaneously with the qualitative aspects of water resources if optimum use is to result. Research should be undertaken to update and streamline all laws within the State pertaining to water and related resources management and also with a view to making legal terminology and definitions more closely reflect the advances in scientific knowledge; to provide the basic information necessary for the implementation of systems of charges for water withdrawals from, and effluent discharges to, bodies of water and also for in-stream water uses; to better establish the extent of the groundwater resources, the hydraulic characteristics of these resources, and the effects of urbanization upon the use, conservation, and quality of these resources. This is necessary to facilitate the recommended integrated management of ground and surface water resources; and to provide the necessary data for the development of mathematical models of the major streams and the use of the recommended communications-control networks for water quality management. In this respect the Mississippi River Basin should receive top priority. (See also W71-01358)
W71-01300

WATER SYSTEM ELEMENT STUDY.

Los Angeles Dept. of City Planning, Calif.
For primary bibliographic entry see Field 06D.
W71-01339

EFFECT OF QUALITY FACTORS ON WATER-BASED RECREATION (IN WESTERN NEVADA),

Nevada Univ., Reno. Desert Research Inst.
George A. Myles.

Available from NTIS as PB 195-778, \$3.00 in paper copy, \$0.95 in microfiche. Desert Research Institute Progress Report Series 3E; and Nevada Agricultural Experiment Station, University of Nevada, Bulletin 24, February 1970, 70 p., 37 tab., 4 fig., 1 ref. OWRR-A-015-NEV (1).

Descriptors: *Recreation facilities, *Decision making, *Tourism, *Consumptive use, *Nevada, *Recreation demand, Attitudes, Behavior, Arid lands, Water demand, Summer, Data collections, Climatic data, Surveys, Social aspects, Lakes, Water quality, Animals, Plants, Temperature, Water sports, Benefits, Limiting factors, Waste disposal.
Identifiers: *Quality factors, *Water-based recreation.

To make the best decisions about increasing water-based recreation, it is desirable to know how visitors regard various factors that affect site quality. A 1966 summer study of visitor attitudes toward site quality factors at four western Nevada lakes had the purposes of: (1) collecting physical data, including wind speed, cloud cover, air and water temperature, water odors and water coliform count of the sites; (2) correlating this data with visitor's attitudes; (3) counting the number of automobiles parked at recreation areas; (4) determining the amount of litter and trash at these sites; and (5) determining visitors' attitudes. The 25 major findings are summarized in terms of visitor preference to site and travel, group size, site setting and appeal, occupational correlations, animal and insect problems, tree preference, coliform count, parking and facility needs, concessions and cooking needs, swimming and crowding problems, advertisements, reasons for patronizing, benefits derived, time factors, litter and car counts and willingness to pay for access to facilities. The 29-part visitor questionnaire is included. (Popkin-Arizona)

W71-01341

RATE OF RETURN AND BUSINESS RISK,

Paul H. Cottner, and Daniel M. Holland.
Bell Journal of Economics and Management Science, Bell Telephone Co. Autumn 1970, Vol. 1, No. 2, p 211-226.

Descriptors: *Risks, *Capital, *Investment, Profit, Economics.
Identifiers: *Rates of return.

Study findings are condensed that sought to measure the relationship between risk and rate of return. This was done in order to implement Supreme Court decisions which held that the permitted rate of return on capital of a regulated public utility should be similar to that in other business undertakings with corresponding risks and uncertainties. Defining business risk as functionally related to the variability of earnings, a number of hypotheses regarding risk and return are tested statistically, and correlations between them are discovered both for a sample of industries and individual companies. The statistical model, however, explains only about a quarter of the variability in rates of return among industries and firms. The final section examines results in the light of recent developments in the theory of financial risk. This discussion relates to a little-understood question, the utility of uncertain events. It is important to water resources policy and planning in order to evaluate uncertainty aspects of both flood and drought damage situations and to understand the economic basis for flood insurance. (Whipple-Rutgers)
W71-01346

ECONOMICS OF WATER QUALITY MANAGEMENT.

Iowa State Univ., Ames. Dept. of Economics.
John F. Timmons, and Merwin D. Dougal.
Reprint, International Conference on Water for Peace, May 23-31, 1967, Washington, D.C., (1967). 47 p, 2 tab, 7 fig. OWRR Project A-DD1-IA (1).

Descriptors: *Economics, *Water quality, *Water quality management, Benefits, Cost-benefit analysis, Cost comparisons, Water pollution.

The three dimensional framework for water quality management includes physical economic and structural dimensions. The structural dimension includes institutional, cultural, legal influences. The three classes of fundamental relationships between water users may be characterized respectively as neutral, complementary and competitive, the third constituting the core of water quality problems. Competitive relationships are classified as (1) encroaching, (2) spatial-preclusion, (3) temporal-preclusion and (4) compensatory-continuance. Analyses of various competitive situations are analyzed and illustrated graphically, using conventional concepts of marginal analysis, the assumption that benefits can be evaluated quantitatively in money terms and the goal of maximizing net benefit. There is a discussion of the problem of evaluating benefits of water quality. Benefits which can be evaluated include additional costs to maintain usability of water of reduced quality, reduction of value of product, and value of foregone opportunities in the case of preclusion. Recreation values are categorized as debatable. The difficulty of assigning a single quantitative measure to pollution is recognized, and the 'pollution set' approach is mentioned. The approach of assuming a water quality objective and optimizing by means of selecting the least cost alternative is discussed briefly. An illustrative example of an Iowa stream is discussed. (Whipple-Rutgers)
W71-01349

ENVIRONMENTAL ECONOMICS OF INDUSTRIAL WATER UTILIZATION IN SOUTH CAROLINA,

Clemson Univ., S.C.
James M. Stepp.

Field 06—WATER RESOURCES PLANNING

Group 6B—Evaluation Process

Preprint, Paper for South Carolina Industrial Developers Association Meeting, Myrtle Beach, South Carolina, May 14, 1970. 19 p. OWRR Project A-017-SC (3).

Descriptors: *Industrial water, Electric power industry, Pulp and paper industry, Cooling water, Chemical wastes, Cost-benefit analysis, South Carolina.

Economic benefits are compared with the environmental costs of industrialization in South Carolina. The author pays particular attention to three types of wet-process manufacturing industries in the state, pulp and paper mills, textile finishing plants and chemical plants. He tries to relate the amount of water pollution caused by these industries, measured in terms of their biochemical oxygen demand (BOD), with the employment and tax benefits that they provide to the communities in which they are located. He concludes that various communities will react to the comparative costs and benefits differently, making it important to the potential industrial developer to investigate his potential community carefully. (Holmes-Rutgers) W71-01351

RESOURCE MANAGEMENT IN THE COASTAL ZONE: THE POLICY PROBLEM, Clemson Univ., S.C. Dept. of Agricultural Economics and Rural Sociology. J. C. Hite, and E. A. Laurent. (1970). 6 p. OWRR Project B-012-SC (1).

Descriptors: *Coasts, Systems analysis, Multiple purpose projects, Water resources development, South Carolina.
Identifiers: *Low Country (South Carolina).

This article attempts to set up a conceptual framework for public management of South Carolina's coastal areas. The authors first explain why the management of the coastal zone is a public or state concern and why the government is in an optimal position to serve as a 'central link between the participants in the planning process.' They conclude that systems analysis provides the best method for developing a multiple use management plan that could successfully integrate all the demands for use of the coastline. (Holmes-Rutgers) W71-01352

ECONOMICS OF WATER QUALITY: AN APPLICATION TO THE DES MOINES RIVER BASIN.

Iowa Univ., Iowa City. Dept. of Economics. Harold Lofgreen, and Jerald R. Barnard. Iowa Business Digest, Vol. 40, No. 1, Feb. 1968. 11 p, 1 tab, 4 fig, 10 ref. OWRR Project A-018-IA (2).

Descriptors: *Water pollution control, *Low flow augmentation, *Waste treatment, *Pollution abatement, Regulation, Water management.

The traditional economic approach of equating marginal costs of treatment with marginal costs of damage avoided is impracticable to apply because of difficulties of evaluating damages to fish and wildlife, recreation, etc. Therefore basic water quality standards for streams have been set arbitrarily; the economists' task now being redefined as the obtaining of such standards with the minimum social costs. In their further discussion the authors assume dissolved oxygen to be the indicator of water quality, although it is realized that this may not always be the case. There is outlined the economic relationship between alternatives of effluent treatment and of flow augmentation (by reservoir storage) for the obtaining of different degrees of water quality. Data regarding unit costs of treatment are taken from publications of the Senate Select Committee (1960), applied to populations of the Des Moines River. The costs of flow augmentation on the river are taken from Corps of Engineers estimates of a proposed reservoir. The results of the treatment upon the stream are derived by means of 'rule-of-thumb' estimates of assimilative capacity. In this particular case, the combination of flow augmenta-

tion provides a lower cost alternative than treatment only. (Whipple-Rutgers) W71-01353

ALTERNATE METHODS OF FINANCING WASTE TREATMENT FACILITIES, Union Securities and Co., New York. James W. Lopp.

Water and Wastes Engineering, Vol. 7, No. 3, March 1970, p. 59-62.

Descriptors: *Financing, *Government finance, Cost repayment, Economics, Water law, Pollution abatement, Water pollution control, Waste treatment.
Identifiers: *Financial alternatives, *Financing techniques, General obligation bonds, Revenue bonds.

The cost of controlling environmental pollution will be high. The government has authorized several billion dollars for federal construction grants, but it is likely that not all of it will be appropriated. Industry is moving to comply with water quality standards at a rate sufficient to meet the 1972 deadline. Municipal sewerage construction is lagging and will not meet the deadline at its present rate. Money is the major shortage, and financing is the major problem. General obligation bonds are often used, but they are restricted practically and by law. State governments are aiding municipalities directly and through special financing agencies. Industry is being encouraged to construct pollution control facilities through tax measures and state and federal aid. Joint industrial - municipal projects may be advantageous both through economy of scale, and federal - state aid. Industrial and municipal revenue bonds may also be used to construct sewerage works. Federal alternatives include direct requisitions by the FWPCA to the Treasury Department which would be funded by the sale of Second Liberty Bonds. Federal bond issuing agencies which would buy tax exempt municipal bonds are also a possibility. (Hewett-Rutgers) W71-01355

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA, Minnesota Univ., Minneapolis. Water Resources Research Center.

Ulric P. Gibson, Conrad P. Straub, and Richard G. Bond. Available from NTIS as PB 195-779, \$3.00 in paper copy, \$0.95 in microfiche. Minnesota Water Resources Research Center WRRRC Bulletin 23, August, 1970. 222 p, 14 tab, 53 fig, 112 ref. OWRR Project A-018-Minn (2).

Descriptors: *Water resources development, *Water quality, *Legislation Minnesota, *Utilization, *Management, Planning, Effluents, Withdrawals, Urbanization, Mathematical models, Networks, Mississippi River Basin, Costs.
Identifiers: Effluent charges, In-Stream water use.

This study was designed to develop criteria for the management of water quality as an integral part of water resources management, and methodology for implementing such integrated management in the State of Minnesota. The concept of integrated water resources management is developed in some detail through many aspects such as the need for, and type of governmental involvement; institutional arrangements; judicial and economic policies, technical measures; the importance of socioeconomic considerations; and the need to consider the wider possible range of alternatives. Approaches to this type of water resources management in three western European countries, Canada, and the United States are discussed. The existing arrangements for water resources management in Minnesota are compared with the criteria developed, weaknesses and deficiencies noted and alternative proposals made for their correction. The study provides information upon which the

reorganization of water resources management in Minnesota may be undertaken. (See also W71-01300) W71-01358

COASTAL CHANGES, Cambridge Univ. (England). Dept. of Geography. J. A. Steers.

In: Future Environments of North America, ed. Darling, F. Frasher and Milton, John P. (Natural History Press: Garden City, New York, 1966), p. 539-551. 4 ref.

Descriptors: *Beaches, *Beach erosion, *Recreation, *Planning, *Aesthetics, *Dunes, *Reefs, Roads, Hurricanes, Sea walls, Earthquakes, Forest management, Vegetation, Land reclamation, Wetlands, Salt marshes, Oil-water interfaces, Landscaping, Tourism.
Identifiers: *Housing developments, Coys, Beach paths, Spartina, British National Trust, Canada, Scotland, Population density.

Various factors bring about coastal changes are discussed with attention given to planning for the future. Man is and will continue to be the major factor with which to contend. The demand for more accommodations on beaches inevitably threatens natural beaches and without clever landscaping even small buildings can be conspicuous. Although fortunes may be made in 'development', the nation as a whole will suffer. The car, and road systems along the coast, in addition to poorly planned paths may deteriorate dunes. Countries with lower population density have quite different problems, the author indicates, and it is suggested that we begin to take an interest in the coast from differing points of view besides sociability. Major natural factors effecting the coast are discussed. Periods of beach recovery from one hurricane are indicated to have been ten years; in another case mentioned coastal retreat initiated by a hurricane actually took place during the months following the storm. Changes on reefs and coys involving the introduction of new vegetation or tourism have made many islands more vulnerable to hurricanes, many having disappeared with storms rather than being built up by captured debris. Effects of sea walls, earthquakes, digging up plants from dunes, and removing forests, are discussed and indicated to have far reaching indirect consequences. Effects of land reclamation on wetlands, effects of oil on beaches, and means of dealing with the grass Spartina are also discussed. Constant changing of barrier islands is pointed out and development of salt marshes described. Finally, the efforts of the British National Trust to buy up unspoiled beach to be kept inviolate are praised. (Preckwinkle-Chicago) W71-01366

RESOURCES PLANNING VERSUS REGIONAL PLANNING, Michigan State Univ., East Lansing. School of Urban Planning and Landscape Architecture. Sanford S. Farness.

In: Future Environments of North America, ed. Darling, F. Fraser and Milton, John P. (The Natural History Press: Garden City, New York, 1966), p. 494-502.

Descriptors: *Planning, *Resource development, *Institutions, *Decision making, *Social needs, *Technology, *Economic efficiency, *Ecology, Multipurpose.
Identifiers: *Resource planning, *Urban regional planning, *Goals, Social science, Implementation.

Five types of 'regional planning' are outlined and the main negative effects of present resource planning and urban regional planning are indicated with suggestions for improved harmonization. The five major types include: resource planning-'economic development'; urban regional planning-'urban habitat'; regional facility planning-'technoeconomic efficiency'; ecological planning-'biological fitness and health'; social institution planning-'implementation.' The author's criticism

of resource planning stems from the gearing toward economic decision making implicit in the terms 'natural resource' and 'human resource.' As resources they are 'means' of instrumental value to our ends. There are, however, many more institutions, social roles, and subsystems besides economics and each has its distinctive decision method and meaning or goal. Resource planning must be pluralistic on a regional basis, and striving for a rational habitat for man realizing a constantly self-trans forming evolutionary process. Problems of regional planning include a lack of any workable consensus regarding urban form with a notion of growth indefinitely extended; the inadequate theory provided by the social sciences has not considered the various forms of social space and has often resulted in mechanistic and reductive terms. Our kind of technology and emergent human needs are indicated as coming into conflict at some critical point. Our dominant institutions in striving to comprehensively coordinate human activity are reinforcing the centralizing effects of present technology. The author concludes by stressing the need for a multi-purpose institution at regional levels which acknowledges the technoeconomic system as only a subsystem, one part of a many facted cultural system of values. (Preckwinkle-Chicago) C
W71-01368

FINDINGS AND RECOMMENDATIONS.

Water Resources Council, Washington, D.C.

Report to the United States Water Resources Council by the Special Task Force, July 1970. 21 p.

Descriptors: *Water resources development, Federal government, Planning, Optimum development plans.

Identifiers: Water resources planning, Comprehensive planning.

The Special Task Force of the Water Resources Council was appointed to review and revise the evaluation practices of Federal agencies in regional or river basin planning and in planning Federal water and related land projects. The Task Force recommended a general policy statement entitled 'Principles for Planning Water and Land Resources.' Procedures were tested on different types of projects to determine whether, in interpreting the evaluation procedures, different teams 'can accomplish appropriate results and achieve reasonably uniform comparability in application.' A seminar in Feb, 1970 showed that some of the tests reflected fairly significant variation in both concept and application. Also, the multiobjective approach to planning is practical. A technical review of the Principles was studied by various Federal, state, and local agencies in June, 1970. Findings and recommendations include: (1) Multiobjectives, which are national economic development, environmental quality, social well-being, and regional development; (2) Benefits and Costs; (3) General Evaluation Principles; (4) Plan Formulation, the concept of an optimum plan; (5) Accounting System; (6) Cost Allocation, Reimbursement, and Cost Sharing; (7) National Program; (8) Participation in Planning; (9) Programs Covered; (10) Council on Environmental quality; (11) Standards; (12) Procedure; (13) Council Action. (See also W71-01370 and W71-01371). (Wray-Chicago)
W71-01369

SUMMARY, FEDERAL AGENCY TECHNICAL COMMENTS ON THE SPECIAL TASK FORCE REPORT ENTITLED 'PROCEDURES FOR EVALUATION OF WATER AND RELATED LAND RESOURCE PROJECTS.'

Water Resource Council, Washington, D.C.

Report to the United States Water Resource Council by the Special Task Force, July 1970. 13 p.

Descriptors: *Water resources development, Federal government, Planning, Optimum development plans.

Identifiers: *Water resources planning, Comprehensive planning.

The Federal Water resource agencies commented on the special Task Force Report, entitled 'Procedures for Evaluation of Water and Related Land Resource Project,' in June 1969. These comments are condensed as follows. The concept of multiobjectives to expand project formulation and evaluation studies for uniform and equitable consideration of all relevant planning objectives is endorsed. The discussion on plan formulation is faulted for providing only the vaguest notion of how to proceed with formulating a plan to meet multiple objectives. Also, since only the objective of national economic development can be analyzed by standard benefit-cost techniques, the other three objectives will suffer. The use of benefits and costs analysis in planning requires more consideration, especially to devise uniform measurement standards. A more explicit definition of 'national economic benefits' would be valuable in the report. Benefit evaluation procedures need to be standardized so that the values do represent positive net income benefits. The report perpetuates the difficulty of separating flood control and drainage functions. Conventional benefit-cost analysis at present is an insufficient means of evaluation for the environmental objectives. The objective of providing for social well-being is new in concept and requires long-term attention. Secondary benefits should be computed in all areas where basic conditions exist and not limited to so-called redevelopment areas. Examples are needed to explain the use of accounting tables. Appropriate guidelines are needed for regional delineation. The evaluation procedure may be applicable only to Federal projects. (See also W71-1369 and W71-01371) (Wray-Chicago)
W71-01370

SUMMARY AND INDEX, PUBLIC RESPONSE TO THE SPECIAL TASK FORCE REPORT ENTITLED 'PROCEDURES FOR EVALUATION OF WATER AND RELATED LAND RESOURCE PROJECTS.'

Water Resources Council, Washington, D.C.

Report to the United States Water Resources Council by the Special Task Force, July 1970. 7 p, 3 append.

Descriptors: *Water resources development, Water management, Planning.

Identifiers: *Water resources planning, Comprehensive planning.

The opinions of participants in the August-September 1969 public hearings on 'Procedures for Evaluation of Water and Related Land Resource Projects' are presented in this report. Many said the Task Force report should be rewritten to simplify, clarify, and establish explicit guidelines. Other groups, especially conservationists, felt the report was biased in favor of construction and would be able to search for more benefits for marginal projects. Local government officials, port authorities, etc. however, were pleased with the innovations. There were some disagreement on whether the national account or environment should be weighed as benefits. The benefit-cost system was viewed from opposing positions by conservationists and city officials. In considering secondary benefits, one group saw little value in measuring them, while the other group felt secondary benefits should be stressed. Testimony on interest rates also covered a wide spectrum. Some reviewers commented that construction agencies should be separated from the planning because of their difficulty in making unbiased analyses of favorable and adverse effects. Suggestions were made to use economic analysis in other Federal programs; to include solvage or residual values in resource planning; to include cost allocation and repayment policy; to revise the recreation day values upward; and to require mitigation protection for wildlife. (See also W71-01369 and W70-01370) (Wray-Chicago)
W71-01371

NATURAL RESOURCES, AND ECONOMIC DEVELOPMENT: THE WEB OF EVENTS, POLICIES AND POLICY OBJECTIVES,

Resources for the Future, Inc., Washington, D.C.

Joseph L. Fisher.

In: Future Environments of North America, ed. Darling, F. Fraser and Milton, John P. (The Natural History Press: Garden City, New York, 1966), p 261-276. 1 tab, 5 ref.

Descriptors: *Natural resources, *United States, *Social aspects, *Economic impact, *Technology, Multiple purpose, Conservation, Ecology, Aesthetics.

Identifiers: *Economic development, *Events, *Policies, Policy objectives, Multiple resource approach, Canada.

Economic development and use of natural resources in the United States and Canada are reviewed in terms interrelated events, policies, and policy objectives. Reviewed first are highlights in recent U.S. History relating to natural resources. Discussion centers around the leadership of Theodore Roosevelt with Gifford Pinchot and the next major period of thinking during the Depression years up to the present. Major social, economic and technical forces underlying events and policies noted are: population growth, internal shifts of population, growth of recreation; increase of urban land, greater demand for water and pollution abatement, improving agricultural techniques and source of fuel, and finally social characteristics with greater per capita income and homogenization and equalization of classes and regions. Broad policy objectives considered for resources include a rising level of welfare made up of economic, technologic, and aesthetic parts; aid to poorer countries striving for resource and economic development; and national security. The author suggests that testing of specific policies against these objectives would be useful in giving greater direction and consistency to actions. Finally, speculations regarding the future are made. Conclusions are that: age-old concern for resource shortage seems to boil down to a management problem resource quality is becoming more important, planning for several decades ahead interrelating resources and the whole economy of countries and regions should be encouraged, behavioral and institutional changes should contain the problem of over population, and more comprehensive programs for resource conservation will have to be worked out for the future emphasizing multiple-purpose, multiple-resource approaches. (Preckwinkle-Chicago)
W71-01373

REGIONAL VERSUS INTER-REGIONAL EFFICIENCY IN RESOURCE ALLOCATIONS,

Michigan Univ., Ann Arbor.

Gunter Schramm.

Pap, 9th Annu Meet, West Reg Sci Ass, San Diego, Calif. Feb-Mar 1970. 18 p, 2 fig, 28 ref.

Descriptors: *Resource allocation, Resource development, Compensation, Inter-basin transfers, Transfer, *Efficiencies, Water rights, Intangible benefits, Water allocation (Policy), *Water transfer, Natural resources, Costs, Economic efficiency, Economics, Benefits, Bibliographies, Benefit sharing, Optimum development plans, Water resources, Planning.

Identifiers: Regional planning, *Benefit-cost analysis.

The question is investigated of whether introduction of compensation payments for transfer of resources between independent regions having unequal endowments of resources such as water would lead to efficient allocation and utilization of the resources. The basic assumption of the analysis is that different regions have jurisdiction or ownership rights over their resources and determine existing and future utilization. The analysis was conducted in terms of usual benefit-cost terminology, with net benefits referring to the present value of the sum of public and private total benefits minus the sum of public and private total costs. The analy-

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sis shows that the range and magnitude of opportunity costs are different for different regions, and the sum of efficiency solutions of individual regions is not necessarily equal to the optimum interregional efficiency solution. Problems of defining relevant regional and interregional benefits are discussed. The analysis shows that regional ownership of resources is likely to result in interregional inefficiency and that a system of compensation payments will reduce but not eliminate these inefficiencies. (USBR)
W71-01385

FERTILIZATION OF IRRIGATED GRAIN SORGHUM, NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 021.
W71-01397

PARTICIPATION IN WATER BASED RECREATION BY NEVADA RESIDENTS AND TOURISTS,
Nevada Univ., Reno. Div. of Agricultural Economics and Education.
George A. Myles.
Nevada Agricultural Experiment Station, University of Nevada, Bulletin 21, September 1969. 40 p, 26 tab, 1 fig, 8 ref. OWRR A-019-NEV (2).

Descriptors: *Water demand, *Water sports, *Tourism, *Consumptive use, *Nevada, Recreation demand, Attitudes, Decision making, Behavior, Arid lands, Recreation facilities, Data collections, Surveys, Statistics, Camping, Lakes, Streams.
Identifiers: *Water-based recreation, Reno (Nevada), Las Vegas (Nevada).

Out-of-state tourists and Nevada residents are visitors to Nevada's recreation sites. Residents in the Reno and Las Vegas areas were questioned by mail and out-of-state tourists passing through Reno were interviewed to provide information on water based recreational attitudes. Characteristics of visitors with nonvisitors are compared. Estimates of percentage of the resident and tourist populations who visit and reasons for visiting or not visiting water based recreation sites are given. This information supplements the data collected in on-site interviews to provide a better understanding of factors which affect participation in water recreation. The first part of the report is concerned with residents and the second part with out-of-state tourists. Summaries of 15 conclusions about Nevada urban residents and 8 conclusions about tourists to northwestern Nevada are presented for 1967. These summaries are concerned with frequency and recurrence of visit, car and boat ownership, time spent, preferred activities, facilities and attractions, reasons for not visiting, improvement suggestions and financial willingness to support the sites. (Popkin-Arizona)
W71-01407

MINIMAL COST ESTIMATION FOR LAKEFRONT SEWAGE SYSTEMS,
New Hampshire Univ., Durham. Water Resources Research Center.
Kenneth W. Norton, and Robert H. Forste.
Available from NTIS as PB-195 782, \$3.00 in paper copy, \$0.95 in microfiche. Water Resources Research Center, Technical Working Paper No. 1, Jan. 1969. 20 p, 1 tab, append. OWRR Project A-008-NH (6).

Descriptors: *Estimated costs, *Estimating, Feasibility, Water pollution control, Pollution abatement, Economics, Project feasibility, Economic feasibility, Sewage disposal, Project planning.
Identifiers: *Minimal cost estimation, Lakefront sewerage.

The objectives of this paper were to estimate the minimal cost of a municipal sewerage system for

the Pawtuckaway Lake area of Nottingham, N. H., and to develop a method of estimating minimal cost that would be applicable in other similar situations. Equations for determining the diameter of the main sewer and the length of required sleeve pipe were developed in terms of the percentage of land suitable for development, the development density of shore front lots, and the development density of back lots. Items which were included in the cost estimate were: a sewage treatment plant, pumping stations, manholes, manhole covers, major pipes including excavation and backfill, and four inch sleeve pipe also including excavation and backfill. The total minimal cost of these items was expressed as the summation of all the unit costs times their respective required quantities. Although the method was developed for the Pawtuckaway Lake area, a generalized formula is given which may be applied to estimate the minimal cost of other lake-front sewerage systems. (Hewett-Rutgers)
W71-01410

UNITED STATES V WEST VIRGINIA POWER CO (VALUATION OF PROPERTY CONDEMNED FOR DAM SITE).
For primary bibliographic entry see Field 06E.
W71-01457

ANALYSIS OF RECREATIONAL USE OF SELECTED RESERVOIRS IN CALIFORNIA,
California Univ., Davis. Dept. of Agricultural Economics.
Victor S. Pankey, and Warren E. Johnston.
Available from NTIS as AD-701 949, \$3.00 in paper copy, \$0.95 in microfiche. Army Engineering District, Sacramento, July 1969. 42 p, 14 ref. Contract DAC-05-67-C-0036.
Identifiers: *Recreation, *California, *Lakes, Recreation, Public opinion, Group dynamics, Mathematical prediction, Performance (Human), Mathematical models, Regression analysis, Population, Sociometrics, Economics, Quality control, Periodic variations, Reservoirs, Socioeconomic status.

The study is based on recreation use data collected at seven Corps of Engineers reservoirs in California. The two basic objectives of the study were to evaluate and attempt to isolate factors influencing recreation use, and develop recreation use prediction models. The technique used is multiple linear regression. The study generalizes the 'Clawson-Hotelling' prediction model for estimating demand at selected reservoirs in California using distance from the site as a proxy for price. Alternative prediction models employ distance zones about sites or county of origin of users of each site, and results from the alternative models are compared. The various factors or variables examined included socio-economic variables relating to income, age, education, urbanization, and population of the zones (counties) and certain site specific variables to differentiate either quality and/or quantity of the recreation experience at reservoirs. Findings of the study relate only to recreation use prediction at reservoir sites in California. However, these findings will provide the bases for development of more sophisticated prediction models having wider application and also for further studies in the determination of the economic value of water-based recreation.
W71-01503

RECREATIONAL DEVELOPMENT OPPORTUNITIES OF THE INTRACOASTAL WATERWAYS IN NORTH CAROLINA, SOUTH CAROLINA AND GEORGIA.
Coastal Plains Regional Commission, Washington, D.C.

Available from NTIS as PB-189 189, \$3.00 in paper copy, \$0.95 in microfiche. Coastal Plains Regional Commission, November 1969, various pagings. 66 tab, 17 fig.
Identifiers: Urban planning, Inland waterways, *Inland waterways, *Recreation, Recreation,

Economics, Traffic, Marine engineering, Boats, Buildings, Population, Georgia, North Carolina, South Carolina, Maps, Tables, Coastal plains region, Area planning and development, Land use.

Contents: Summary of findings; Promotion of intracoastal waterway; Specific investment opportunities; Holiday afloat; Dixie bateau; Future development; Financing sources; Implementation program.
W71-01514

PHYSICAL RESOURCES.

Capital District Regional Planning Commission, Albany, N.Y.

Available from NTIS as PB-190 176, \$3.00 in paper copy, \$0.95 in microfiche. December 1969, various pagings. 95 ref.
Identifiers: *Urban planning, New York, *Natural resources, Inventory, Terrain, Climatology, Air pollution, Water supplies, Soils, Water pollution, Minerals, Agriculture, Land use, Urban planning and development.

The physical resource inventory and analysis study was undertaken by Metcalf and Eddy, Inc., for the Capital District Regional Planning Commission (CDRPC) as one of the studies in its initial work program. It is intended to formulate the ground work for the eventual completion of a future development plan for the 2,219 square mile Capital District Region. The intention of this study is to inventory data on the significant natural physical features of the Region and analyze the role they play with the Capital District Region. Maximum use has been made of existing studies and expert knowledge of conditions in the Region. New research has been added only where necessary.
W71-01525

DEVELOPMENT BENEFITS OF WATER RESOURCE INVESTMENTS,
Washington Univ., St. Louis, Mo.
Charles L. Leven.

Available from NTIS as AD-704 714, \$3.00 in paper copy, \$0.95 in microfiche. Army Engineer Institute for Water Resources, IWR Report 69-1, November 1969. 443 p. Contract DA-49-129-CIVENG-66-11.
Identifiers: *Water supplies, Economics, Labor, Employment, Wages, Industries, Mathematical models, Water resources, Water consumption, *Water resource investments, Economic impact.

The project focuses on the question of the determination and evaluation of developmental benefits of water resource investments. The study recognizes that in addition to producing services whose value to users would be benefits of an investment project, that the project itself might produce additional changes in the economy of the region in which it was located. In other words, in addition to the value of water resource services to water service users (primary benefits) it is recognized that water resource investments might cause an enhancement of a region's economy by way of inducing the expansion or formation of economic activities in that area. (See also W71-01531)
W71-01530

DEVELOPMENT BENEFITS OF WATER RESOURCE INVESTMENTS. APPENDICES,
Washington Univ., St. Louis, Mo.
Charles L. Leven.

Available from NTIS as AD-704 715, \$3.00 in paper copy, \$0.95 in microfiche. Army Engineers Institute for Water Resources IWR Report 69-1-A, November 1969. 339 p. DA-49-129-CIVENG-66-11.
Identifiers: *Water supplies, Economics, Labor, Employment, Wages, Industries, Mathematical models, Water resources, Water consumption, *Water resource investments, Economic impact.

Contents: The efficacy of labor migration with special emphasis on depressed areas; The influence of community characteristics on the relationship of unemployment changes to employment changes in major labor market areas; Programs for computerized location models for assessing regional shifts in industrial location; Economic base and input-output models and their role in regional analysis; Combination transforms for the aggregation of interregional commodity flows, and Interindustry analysis tables for Appalachia, Ozarks and rest of the United States. (See also W71-01530)
W71-01531

THE WATER CRISIS,
For primary bibliographic entry see Field 06E.
W71-01566

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT OF THE COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 90th CONGRESS, 1st SESSION.
For primary bibliographic entry see Field 06E.
W71-01605

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

GRAZING VS. WHEAT PRODUCTION ON MARGINAL UTAH CROPLAND,
Utah State Univ., Logan. Dept. of Range Science.
For primary bibliographic entry see Field 03F.
W71-01297

RATE OF RETURN AND BUSINESS RISK,
For primary bibliographic entry see Field 06B.
W71-01346

THE COST OF IMPROVING WATER QUALITY IN THE GREAT LAKES,
State Univ. of New York, Syracuse. Water Resource Center.
Robert D. Hennigan.
Water and Wastes Engineering, Vol. 6, No. 1, January 1969. p A-28-A-31, 1 tab.

Descriptors: *Great Lakes, *Great Lakes Region, *Estimated costs, *Total costs, Water quality, Water quality control, Costs, Water pollution control, Pollution abatement, Planning, Federal government, Local government, Institutions.

About 11 billion gallons of water are drawn from the Great Lakes each day. Nearly all of this is returned as treated or untreated waste water including nearly every imaginable type of natural, urban and industrial pollution. Water quality has deteriorated considerably with concomitant upset of the ecology, and decrease in recreational usefulness, etc. A great deal of planning, regulation, construction and money is required to stop the deterioration of the Great Lakes. The total five year cost for water quality improvement is approximately \$3.7 billion. About 95% of this is for construction and operation of municipal and industrial waste treatment facilities. A 30% federal, 30% state, and 40% local share of treatment facilities cost is a fair allocation if no ceilings exist on individual projects of available funds. When the cost of sewer construction is included, the allocation becomes 15% federal, 15% state, and 70% local because sewer costs are generally not eligible for federal aid. The federal government, state and local agencies need a focus, staff, budget, and independence to provide executive responsibility. If the proper institutional arrangements are not forthcoming, great sums of money will be wasted and goals not realized. (Hewett-Rutgers)
W71-01354

FERTILIZATION OF IRRIGATED GRAIN SORGHUM, NORTHEASTERN BRANCH STATION,
New Mexico Agricultural Experiment Station, University Park.
For primary bibliographic entry see Field 02I.
W71-01397

THE PUBLIC TRUST IN TIDAL AREAS: A SOMETIME SUBMERGED TRADITIONAL DOCTRINE.
For primary bibliographic entry see Field 06E.
W71-01548

CITY OF PHILADELPHIA V STANDARD OIL CO (RIPARIAN OWNER'S LIABILITY FOR RENT FOR USE OF CITY'S BULKHEAD).
For primary bibliographic entry see Field 06E.
W71-01630

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 2ND SESSION.
For primary bibliographic entry see Field 06E.
W71-01634

HEARINGS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT—WATERSHED PROJECTS, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.
For primary bibliographic entry see Field 06E.
W71-01635

6D. Water Demand

FORECASTING DEMAND FOR URBAN WATER SUPPLY,
Stanford Univ., Calif. Program in Engineering Economic Planning.
Peter W. Whitford.
Available from NTIS as PB-195 664, \$3.00 in paper copy, \$0.95 in microfiche. Project on Engineering-Economic Planning, Report EEP-36, September 1970. 221 p, 14 fig, 23 tab, 119 ref. OWRR Project C-1635 (No 3150) (2).

Descriptors: *Forecasting, *Future planning (Projected), *Domestic water, Water demand, Water utilization, Appliances, Sprinkling, Pricing, Maryland, Missouri, Arizona, Washington.
Identifiers: *Metropolitan studies, *Alternative futures, Water use per capita, Baltimore, Kansas City, Phoenix, Seattle.

Conventional methods of forecasting future demand for municipal water supply were found to give undue emphasis to historical rates of use, to ignore many relevant factors, and to fail to distinguish between components of use. This study is concerned with only the residential part of urban water use, the components of which, such as lawn sprinkling, toilet flushing, washing machines or air conditioning, are discussed in turn with consideration given to price sensitivity and possible future trends. A forecasting model or framework for analysis is proposed. Six factors influencing future water use are: regulations on the water use of appliances; the type of pricing policy that is adopted; policy on public education; the housing patterns of the future; the cost of supply; changes in the technology of use. Two or three outcomes are considered for each of these factors and combinations of these outcomes form alternative descriptions of the future. Four case studies are used (Baltimore, Kansas City, Phoenix and Seattle) and, for each case, a 'baseline' estimate is made which reflects past trends. Then the effect on water use of each alternative future is estimated. Probabilities are subjectively assigned to each outcome, allowing a probability distribution of future water demand to be drawn.

W71-01189

ALMO WATER CO V JONES (RIGHT TO APPROPRIATE WATER).
For primary bibliographic entry see Field 06E.
W71-01302

KENNILWORTH MANAGEMENT CO V CITY OF ITHACA (REFUSAL OF CITY TO SUPPLY WATER UNDER CONTRACT).
For primary bibliographic entry see Field 06E.
W71-01307

WATER SYSTEM ELEMENT STUDY.
Los Angeles Dept. of City Planning, Calif.

Staff report, August 1968. 17 p. City Plan Case 19716.

Descriptors: *City planning, *Planning, *Long-term planning, *Water resources development, *Water supply, Colorado River, Colorado River aqueduct, Los Angeles aqueduct, Groundwater recharge, Water spreading, Water tanks, Water policy, California.
Identifiers: *Los Angeles (Calif), *Comprehensive master plan, Owens River, Los Angeles River, California aqueduct.

The Los Angeles City Planning Department, in collaboration with other concerned City agencies, is developing a Comprehensive Master Plan. The Water System Element is one of 22 technical elements of the present Plan scheduled for revision. The publication describes the present source of water from groundwater and surface lakes and streams, including the Colorado, Owens and Los Angeles Rivers. Water quality, storage reservoirs, and distribution facilities are discussed. Future water needs, sources, and facility needs to the year 2000 are outlined. The annual water consumption in Los Angeles City is expected to increase from the present 169 billion gallons to 292 billion gallons. In addition to a second Los Angeles aqueduct and increased use of Colorado River water, the City will receive Northern California water via the California Aqueduct, about 1971. The world's largest plant for converting sea water, planned by the federal government in conjunction with local utility companies, is mentioned. It is planned for construction on an island to be constructed off the coast of Orange County. The feasibility of using reclaimed waste water for irrigation, industry, and groundwater replenishment is being examined. A statement of policy of the City Planning Commission concerning the Water System Plan is included. It covers the purpose and objectives of the plan, standards, and criteria. The features of the plan are discussed briefly. The Planning Commission's policy on water storage tanks is also discussed. (Poertner)
W71-01339

EFFECT OF QUALITY FACTORS ON WATER-BASED RECREATION (IN WESTERN NEVADA),
Nevada Univ., Reno. Desert Research Inst.
For primary bibliographic entry see Field 06B.
W71-01341

VERMONT SHADE ROLLER CO V BURLINGTON TRACTION CO (INTERPRETATION OF WATER RIGHTS UNDER CONTRACT).
For primary bibliographic entry see Field 06E.
W71-01382

ENERGY METABOLISM AND PULMOCUTANEOUS WATER LOSS OF AUSTRALIAN HOPPING MICE,
California Univ., Irvine. Dept. of Population and Environmental Biology; and Monash Univ., Clayton (Australia). Dept. of Zoology.
Richard E. MacMillen, and Anthony K. Lee.

Field 06—WATER RESOURCES PLANNING

Group 6D—Water Demand

Comparative Biochemistry and Physiology, Vol 35, p 355-369, No 2, 15 July 1970. 5 fig, 3 tab, 23 ref. NSF Grant GB-5618.

Descriptors: *Temperature, *Physiological ecology, *Xerophilic animals, *Thermal stress, *Cooling, Laboratory tests, Arid lands, Thermal conductivity, Oxygen demand, Burrows, Animal physiology, Water loss.

Identifiers: *Fossorial animals, *Pulmocutaneous water loss, *Hyperthermia, *Australian hopping mice, *Basal metabolic rate (BMR), Ambient temperature.

Changes in body temperature (T sub B), oxygen consumption (BMR) and pulmocutaneous water loss (PWL) with changes in ambient temperatures (T sub A) were measured in 2 species of captured Australian hopping mice (*Neotomys alexis* and *Neotomys cervinus*). Both species maintained a fairly constant T sub B below 37 degrees C. and at or above that temperature became hyperthermic. Both BMR and PWL were inverse linear functions of T sub A. Thermal conductance is inconstant below thermal neutrality and the BMR is below predictable values based on body size. Apparently both species must rely upon hyperthermia during periods of high T sub A. This occurs in conjunction with lower heat production as indicated by depressed BMR values. It is speculated that burrow conditions are often characterized by a high T sub A and high relative humidity, reducing the possibilities of evaporative cooling. These concepts are important in understanding the adaptive physiology of desert animals to extreme fluctuations of temperature and water availability in their environment. (Casey-Arizona) W71-01401

PARTICIPATION IN WATER BASED RECREATION BY NEVADA RESIDENTS AND TOURISTS.
Nevada Univ., Reno. Div. of Agricultural Economics and Education.
For primary bibliographic entry see Field 06B. W71-01407

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (EXCESSIVE WITHDRAWAL OF WATER FROM RIVER).
For primary bibliographic entry see Field 06E. W71-01422

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (LICENSING OF POWER COMPANIES).
For primary bibliographic entry see Field 06E. W71-01564

DOLL V BLITZ (RIGHT TO REASONABLE DOMESTIC USE OF SPRINGWATER).
For primary bibliographic entry see Field 06E. W71-01569

6E. Water Law and Institutions

MEDDOCK V NATIONAL TRANSIT CO (LIABILITY FOR POLLUTION OF SPRING BY LEAKAGE OF OIL FROM PIPELINE).

161 A 628-630 (Pa 1932).

Descriptors: *Pennsylvania, *Water pollution, *Oil, *Leakage, Pollutants, Springs, Impaired water quality, Water pollution sources, Oil wastes, Oily water, Pipes, Pipelines, Pipe flow, Conduits, Judicial decisions.

Plaintiff brought an action in trespass to recover damages for defendant corporation's contamination of the waters of a spring on his land. Plaintiff contended that defendant, in transporting crude oil through pipelines extending across plaintiff's land,

negligently maintained the pipes so as to allow a leak to develop, from which oil escaped and contaminated the spring. Defendant contended that it was not strictly liable for leakage, but instead was only liable if it had failed to repair the leaks. Defendant contended that it had in fact immediately repaired the leaks and thus was not liable. The court held that under applicable statutes defendant was to be held liable not for the leaks, but only for a failure to repair the leaks. However, the court found sufficient evidence to indicate that the leaks had not been immediately repaired and that a large quantity of oil had escaped which had contaminated the spring. Defendant was thus liable for plaintiff's damages. (Snow-Florida) W71-01115

SLOSS SHEFFIELD STEEL AND IRON CO V NANCE (LIABILITY FOR BLOCKING NATURAL DRAINAGE OF SURFACE WATERS).
113 So 50-52 (Ala 1927).

Descriptors: *Alabama, *Embankments, *Surface drainage, *Obstruction to flow, Legal aspects, Judicial decisions, Damages, Ponds, Surface waters, Boundaries (Property), Earth dams, Channels, Channel flow, Cultivated lands, Water spreading, Repulsion (Legal aspects), Natural flow, Rain, Rain water, Impoundments.

Plaintiff farmer sued defendant steel company for damages caused by the impounding of surface water on plaintiff's property by the maintenance of an embankment on defendant's land. The embankment which created a pond on plaintiff's land was constructed before defendant acquired its property. The natural drainage of surface water was from plaintiff's to defendant's property. The Supreme Court of Alabama, in reversing a lower court decision for plaintiff, held that the evidence was not sufficient to support the judgment. The court remanded the case, however, holding that the evidence did tend to show that the pond caused the settling and filling of a channel which carried the drainage from plaintiff's land. This caused the land to remain wet and unsuitable for cultivation. This result, caused by defendant's embankment, created a private nuisance and a cause of action and breached the prevailing law that lower lands are subject to a servitude for the natural drainage of higher lands. However, defendant could only be held liable if he maintained the embankment with knowledge of the nuisance it created. (Morris-Florida) W71-01122

HAWKEYE PORTLAND CEMENT CO V WILLIAMS (EASEMENTS FOR WATER SUPPLY).
239 NW 120-123 (Iowa 1931).

Descriptors: *Iowa, *Easements, *Usufructuary right, *Water supply, Watercourses (Legal), Pipes, Springs, Land tenure, Surplus water, Overflow, Natural flow, Pumps, Dams, Reservoirs, Legal aspects, Judicial decisions, Water utilization, Ravines, Relative rights.

Plaintiff cement company sought an injunction to restrain defendant from interfering with its water supply which originated on defendants' land. Plaintiff had entered into an agreement with defendants' grantor for use of the overflow from two springs, and had constructed a tank, pump and pipes to convey such water. However, plaintiff's employees, with the consent of defendants' grantor, later began to cross into the grantor's premises and draw water from one of the springs. When defendants acquired the property, they endeavored to stop plaintiff from taking water in any manner from defendants' land. The Supreme Court of Iowa affirmed but modified the trial court's decree granting plaintiff an injunction. On appeal, defendants conceded plaintiff's rights under the express agreement with their grantor but challenged the right of plaintiff's employees to enter and carry water from defendant's premises. There was no evidence that plaintiff had acquired an easement for its employees to carry

water from defendants' lands, and the court modified the trial court's decree which had been based in part on such an easement. (Duss-Florida) W71-01123

WHARTON V EMPIRE MFG CO (PERMANENT DAMAGES WHERE DEFENDANT OFFERS TO ABATE NUISANCE).
146 SE 867-868 (NC 1929).

Descriptors: *North Carolina, *Ponding, *Damages, *Adjudication procedure, Legal aspects, Remedies, Judicial decisions, Drainage, Lumbering, Industries, Land, Real property, Crops, Puddling, Industrial plants, Water injury.

Defendant's operation of a lumber mill on property adjacent to plaintiff's caused ponding of water on and consequent damage to plaintiff's property. Defendant offered to abate the nuisance. Plaintiff brought action to recover damages which occurred up to the time of the trial and permanent damages. The issues of damages for temporary and permanent injury were submitted to the jury, which arrived at a verdict assessing defendant for present and future damages. Defendant contended that, in the light of its offer of abatement, the issue of permanent damages should not have been submitted to the jury. The Supreme Court of North Carolina reversed the judgment of the lower court for plaintiff as to permanent damages. There was no permanent appropriation of plaintiff's land, and therefore he was not entitled to recover permanent damages. (Dye-Florida) W71-01131

SHEMME V KRAMER (LIABILITY FOR DIVERSION OF SURFACE WATER).
228 NW 561-562 (Iowa 1930).

Descriptors: *Iowa, *Surface water, *Surface drainage, *Diversion, Drainage, Ditches, Water courses (Legal), Land tenure, Dams, Watersheds (Divides), Natural flow, Topography, Judicial decisions, Legal aspects, Surface runoff, Natural streams, Relative rights, Adjudication procedure.

Plaintiff landowner sought to enjoin defendant landowner from diverting surface water from its alleged natural course onto plaintiff's land. Defendant contended that the natural flow of surface water was onto plaintiff's land. The trial court found for defendant, and the Supreme Court of Iowa affirmed, holding that plaintiff failed to sustain the burden of proof of establishing his case by a preponderance of the evidence. (Duss-Florida) W71-01134

CREECH V UNITED STATES (IMPERVIOUS LEVEE NOT THE CAUSE OF OVERFLOW AND INCREASED WIND TIDES).
60 F Supp 885-896 (Ct Cl 1944).

Descriptors: *United States, *Eminent domain, *Flood control, *Levees, Crops, Compensation, Damages, Florida, Canals, Drainage, Islands, Lakes, Drainage districts, Drainage water, Ditches, Spoil banks, Roads, Hurricanes, Rivers and Harbors Act, Federal government, Floodgates, Navigation, Overflow.
Identifiers: *Lake Okeechobee.

Plaintiff brought suit for damages to their growing crops allegedly caused by the increased water level and wind tides of Lake Okeechobee. Plaintiff farmers grew crops on certain islands in the lake. Defendant, pursuant to special act, built a new, impervious levee to maintain the water level in the lake at 17.6 feet. This level had been determined as the mean average, and most desirable, level at which to maintain the lake. Plaintiffs alleged that the construction of the levee and the resultant overflow of their lands by the increased water level was a deprivation of property without due process of law. The Court of Claims stated that the evidence had

not established plaintiffs' claims. The construction of the levee for flood control and navigation had no appreciable effect on the height of the waters of the lake or on the wind tides. (Barnett-Florida)
W71-01138

BODCAW LUMBER CO V KENDALL (OWNER-SHIP OF NON-NAVIGABLE STREAMBED).

108 So 664-666 (1926).

Descriptors: *Louisiana, *Ownership of beds, *Non-navigable waters, *Leases, Oil, Mining, Navigable waters, Grants, Beds, Bed under water, Federal government, Patents, Bayous, Obstruction to flow, Meanders, Legal aspects, Judicial decisions, Streambeds.

Plaintiff landowner brought action to quiet title to certain lands and to have a lease held by defendant for the purpose of mining on said land and in a streambed annulled. Defendant had secured the lease from the state. Plaintiff contended the state could not grant such a lease since the bed of the stream to which the lease attached was in a non-navigable channel. The court found that the stream was, and had been at the time of the granting of the lease, a non-navigable stream, that the state did not own such stream, and that the state could not, therefore, grant such a lease therein. The trial court's judgment for plaintiff was affirmed. (Price-Florida)
W71-01139

MERIWEATHER SAND AND GRAVEL CO V STATE (POLLUTION OF STREAMS).

26 SW2d 57-63 (Ark 1930).

Descriptors: *Arkansas, *Water pollution control, *Industrial wastes, *Water quality, Water pollution effects, Discharge (Water), Drainage, Streams, Obstruction to flow, Mud, Riparian rights, Riparian land, Riparian waters, Relative rights, Reasonable use, Public rights, Watercourses (Legal), Domestic water, Fish conservation, Fishing, Swimming, Mining, Damages, Legal aspects, Judicial decisions, Remedies.

Plaintiff state and two private parties sought to enjoin defendant company from discharging washings from its gravel beds into a creek. The private parties were riparian owners along the stream. They alleged that defendant's pollution had damaged their land and rendered the streamwater unfit for domestic or agricultural use. Plaintiff state asserted that defendant's acts had rendered the stream unfit for fishing and breeding of fish. The trial court found for plaintiffs. On appeal, defendant contended that: (1) the private individuals were barred from suit by statute of limitations and laches; (2) relief should not have been granted because the damages were slight; (3) the relief would work a hardship on defendant; (4) defendant's business was of great value to the state; and (5) the trial court's decision constituted a dangerous precedent. The Supreme Court of Arkansas affirmed. The cause of action was not barred by the statute of limitations or laches because the injury was progressive and continuing and could not have been foreseen at its initiation. The evidence showed that defendant's acts transformed the stream into one unfit for fishing and breeding of fish. The court held that the public's right was superior to the private right of defendant. (Duss-Florida)
W71-01147

PITTARD V SUMMEROUR (ENJOINING OF ALLEGED NUISANCE).

182 SE 20-21 (Ga 1935).

Descriptors: *Georgia, *Water pollution sources, *Streams, *Wastes, Water pollution effects, Abatement, Industrial wastes, Waste disposal, Legal aspects, Judicial decisions, Non-consumptive use, Chemical wastes, Byproducts, Organic matter,

Waste treatment, Separation techniques, Remedies, Adjudication procedure.

Plaintiff lower riparian owners sought an action to prevent defendant tanners from constructing a tanning facility on a stream that flowed from defendants' land through plaintiffs' farms. Plaintiffs contended that the chemicals and wastes which would result from a tanning facility would pollute the stream's water and make it unfit for domestic use. Defendants contended that no pollution would result from the proposed tanning facility and that adequate safety precautions would be taken. The Supreme Court of Georgia held that an injunction could not be issued against an alleged nuisance where no adequate evidence was given to show the certainty of the nuisance. (Quesada-Florida)
W71-01148

PECK V ALFRED OLSEN CONST CO (STATE'S INTEREST IN NAVIGATION PARAMOUNT TO RIPARIAN RIGHTS).

245 NW 131-138 (Iowa 1932).

Descriptors: *Iowa, *Riparian rights, *Navigation, *Relative rights, State governments, Lakes, Navigable waters, Ownership of beds, Riparian land, Docks, Piers, Riparian waters, Administrative agencies, Administrative decisions, Eminent domain, Adjudication procedure, Remedies, Judicial decisions, Legal aspects, Public rights, Access routes.

Plaintiff riparian owner sought to prohibit the construction of a pier by defendant state in the waters of a lake. Plaintiff alleged that such construction would interfere with his riparian right to ingress and egress, which right he claimed was paramount to defendant's power and duty over navigation. Plaintiff also contended that the proposed structure was not in aid of navigation since its main aspect dealt with land vehicles. The Supreme Court of Iowa, in affirming the trial court's decision for defendant, ruled that land vehicles are closely related to navigation in that materials to be transported by navigation are delivered to the ports by such vehicles. Secondly, the court ruled that a riparian owner's right to ingress and egress is subordinate to both the state and federal governments' interest in navigation. (Barker-Florida)
W71-01149

PERE MARQUETTE RY V SIEGLE (LIABILITY FOR INTERFERENCE WITH ICE BUSINESS BY DAM OPERATION).

260 Mich 89, 244 NW 239-240 (1932).

Descriptors: *Michigan, *Ice, *Dams, *Relative rights, Contracts, Land tenure, Damsites, Ponds, Pounding, Dam design, Operations, Regulation, Surface waters, Remedies, Judicial decisions, Legal aspects, Adjudication procedure, Riparian rights, Riparian land, Ownership of beds.

Plaintiff railway company brought an action to prohibit defendant from operating a dam so as to interfere with plaintiff's right to harvest ice on a pond. Plaintiff had acquired a lease, with the knowledge and consent of defendant's predecessor, to a portion of the pond where an ice business had been operated by plaintiff's lessor. When defendant bought the property on which the dam was located, it operated the dam so as to prevent ice from forming in sufficient quantity to support plaintiff's operations. The Supreme Court of Michigan ruled that plaintiff did not have the right to have the dam operated solely for his benefit, but did have the right to have the dam owners manipulate the dam reasonably so as not to interfere with the formation or harvesting of ice. The trial court's judgment for defendant was reversed. (Barker-Florida)
W71-01150

ZAMANI V OTTER TAIL POWER CO (STATUTE OF LIMITATIONS FOR FLOOD DAMAGE ACTIONS).

234 NW 457-459 (Minn 1931).

Descriptors: *Minnesota, *Flooding, *Dams, *Remedies, Legislation, Damages, Backwater, Floodwater, Adjudication procedure, Legal aspects, Judicial decisions, Land, Real property, Obstruction to flow, Flood damage, Electric power, Powerplants, Structures, Mill dams.

Defendant power company erected a dam which flooded plaintiff's property. Three years later, plaintiff sought permanent damages which resulted from such flooding. Defendant contended that its dam was for milling or manufacturing purposes, and therefore plaintiff's action was prevented by the two year statute of limitations barring action for damages caused by erection of such dams. The Supreme Court of Minnesota, in reversing a judgment for plaintiff, held that defendant's dam was of the type contemplated by the statute. The court noted, however, that a suit to abate the flooding was not barred and that plaintiff could force defendant to abate the flooding or condemn flowage rights on plaintiff's property. (Dye-Florida)
W71-01153

PAHL V LONG MEADOW GUN CLUB (ACQUISITION OF PRESCRIPTIVE RIGHT TO FLOOD).

233 NW 836-838 (Minn 1930).

Descriptors: *Minnesota, *Easements, *Flooding, *Backwater, Floodwater, Dams, Legal aspects, Judicial decisions, Recreation, Obstruction to flow, Damages, Leases, Flow, Flood damage, Bodies of water, Lakes, Land, Real property, Land tenure, Land use, Drainage, Leases.

Defendant gun club maintained a shooting station across a lake from its clubhouse. The water in the lake was too shallow to allow passage of rowboats to the shooting station. To deepen the lake, defendant erected a dam across the lake's outlet. This dam existed for 40 years before plaintiffs brought an action for damages caused by the flowing of their land. Plaintiffs contended that defendant's flooding of the land was a nuisance, which prevented defendant from acquiring a prescriptive right to flow the property, and that defendant's occupation of plaintiffs' land was permissive as it was pursuant to a lease granted by plaintiffs to defendant to hunt and fish. The Supreme Court of Minnesota affirmed a lower court's judgment for defendant. The facts did not indicate that the flowing of plaintiffs' land was a nuisance. Flooding rights may be acquired by prescription. The lease gave defendant only the right to hunt and fish, and consequently all other uses of plaintiffs' property were of a hostile nature, capable of establishing a prescriptive right. (Dye-Florida)
W71-01155

SMITH V GEORGIA POWER CO (LIABILITY FOR FLOODING OF FARM BY OVERFLOW OF DAM).

173 SE 297-299 (SC 1934).

Descriptors: *South Carolina, *Dams, *Crops, *Flooding, Damages, Overflow, Floodgates, Rivers, Compensation, Farms, Agriculture, Flood damage, Saturation, Soaking, Submergence, Water spreading, Rainfall, Impact (Rainfall), Rain, Rainfall-runoff relationships, River forecasting, Legal aspects, Judicial decisions, Water injury.

Plaintiff farm owner sued defendant power company for crop injury from the flooding of his property caused by the opening of the floodgates of defendant's dam. Unprecedented rainfall caused water to overflow defendant's dam. Despite the opening of the floodgates, water continued to overflow the dam, and the water level continued to rise. Defendant contended that under the circumstances, opening the floodgates did not cause plaintiff's injury. Sustaining this contention, the court held that the jury's verdict for plaintiff was unsupported by the evidence and reversed the lower court's decision for plaintiff. (Hart-Florida)
W71-01158

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

COMMONWEALTH V CITY OF NEWPORT NEWS (LEGISLATIVE POWER TO AUTHORIZE DISCHARGE OF SEWAGE).
164 SE 689-700 (Va 1932).

Descriptors: *Virginia, *Tidal waters, *Public rights, *Sewage disposal, Fish management, Legal aspects, Water rights, Judicial decisions, Water policy, Water utilization, Water pollution, Water allocation (Policy), Water resources development, Water pollution control, Pollution abatement, State governments, Regulation, Oysters, Shellfish, Fishing, Fish conservation, Legislation.

Pursuant to a Virginia statute, defendant city discharged untreated sewage into a river. Defendant's actions polluted the tidal waters which were used for planting oysters and other shellfish. Plaintiff state brought action to enjoin defendant's actions. Plaintiff contended that the state held the waters in trust for the people who had a right of fishery. Therefore, the Virginia legislature had no authority to impair the use of the waters by the people for fishery. The Supreme Court of Appeals of Virginia affirmed the lower court's dismissal of plaintiff's action. The court held that defendant was authorized to discharge untreated sewage into the river. The court reasoned that the constitutional provision that natural oyster beds should be held in trust for the benefit of the people did not restrict the legislature's power to authorize use of tidal waters for public purposes. Furthermore, the use of tidal waters for discharge of sewage was a public use. (Powell-Florida)
W71-01165

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME I. CHAPTERS I THROUGH III.

Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-01178

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME II. CHAPTERS IV THROUGH XI.

Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-01179

REGIONAL AND LOCAL LAND USE PLANNING. VOLUME III. APPENDICES I THROUGH IV.

Public Land Law Review Commission, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-01180

DOVER V GEORGIA POWER CO (LIABILITY FOR NEGLIGENCE IN MAINTAINING DAM).

168 SE 117-119 (Ga 1933).

Descriptors: *Georgia, *Dams, *Dam failure, *Flood damage, Dam construction, Damages, Cracking, Gates, Water control, Flow control, Concrete dams, Engineering structures, Judicial decision, Legal aspects, Water injury, Adjudication procedure.

Plaintiff owned a warehouse and property located below the dam of defendant power company. Plaintiff brought an action to recover for flood damage to his cotton seed and other property caused when the dam broke. Plaintiff introduced evidence that a small break had occurred three years before defendant purchased the dam. Defendant had no knowledge of this break and had made no material changes in the dam since its purchase. Conflicting evidence was introduced as to whether the gates in the dam were open or closed prior to the large break. The court reversed the trial court's judgment of nonsuit against plaintiff, holding that negligence in maintaining the dam was a jury

question. The court stated that defendant could not be held responsible for defective construction unless it had notice of the defects, if any. (Powell-Florida)
W71-01181

LITTLE V MARTIN FURNITURE CO (LIABILITY FOR CONTRIBUTING TO THE POLLUTION OF A STREAM).

200 NC 731, 158 SE 490-491 (1931).

Descriptors: *North Carolina, *Pollutant identification, *Septic tanks, *Water pollution, Pollutants, Legal aspects, Wastes, Abatement, Water pollution control, Riparian rights, Judicial decisions, Streamflow, Domestic wastes, Sewage disposal, Sewage bacteria, Waste treatment, Sanitary engineering, Adjudication procedure, Remedies, Damages, Waste disposal, Overflow.

Plaintiff riparian landowner brought an action for damages against defendant furniture company based on defendant's alleged negligence in allowing its septic tanks to overflow. Plaintiff contended that defendant's careless maintenance of its septic tanks polluted the stream which ran through his property and thus damaged plaintiff's use of the stream water for domestic purposes. Defendant contended that it was not the primary or the sole source of the pollution. The Supreme Court of North Carolina held that even though defendant was not the sole source of the pollution, it was still liable for damages to plaintiff proximately caused by the overflow of its septic tanks. (Quesada-Florida)
W71-01182

MOORE V CHESAPEAKE AND O RY (CONSTRUCTION OF GRANTS OF WATER).

167 SE 351-366 (Va 1933).

Descriptors: *Virginia, *Grants, *Water rights, *Water supply, Contracts, Judicial decisions, Legal aspects, Water allocation (Policy), Water delivery, Water requirements, Canals, Mills, Reasonable use, Relative rights, Competing uses, Water utilization, Water demand, Water distribution (Applied).

Predecessors in title of defendant canal owner granted water rights to plaintiff mill owner. The grant obligated defendant to furnish plaintiff with a specific quantity of water in inches. Plaintiff for many years received sufficient but uncalculated amounts of water. When his water supply diminished, plaintiff halted mill operations and brought an action for specific performance. Plaintiff alleged that the water grant in terms of inches was indefinite and that the grant was therefore to be construed in light of past practices. Defendant contended that plaintiff had at all times received all the water to which he was entitled. The Supreme Court of Appeals of Virginia reversed the trial court's judgment for defendant. The court held the grant was specifically enforceable where the terms, though originally indefinite, were made definite by the parties' practical construction. The court reasoned that the grant of water, measured in inches, was intended to provide sufficient water to operate plaintiff's mill. (Powell-Florida)
W71-01184

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME II.

Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-188 062, \$3.00 in paper copy, \$0.95 in microfiche. Final Report, South Dakota State Univ., Agricultural Experiment Station, April 30, 1969. 346 p.

Identifiers: *Agriculture, *Economics, *Water supplies, *Law, Terrain, Disposal, Patents, Costs, Reclamation, Control, Intensity, Statistical data, Deserts, Abundance, Classification, Identification, Management planning, Feasibility studies, United States Government, Homestead Acts.

Contents: Operation of the existing system of agricultural entry and use of the Federal public lands; Effects of the existing system; Potential effects of additional agricultural output from public lands; Analysis of the existing system and some goals, issues and alternatives. (See also W71-01184)
W71-01185

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME III. WORKING PAPERS: FEDERAL PUBLIC LANDS: THEIR DISPOSAL AND PERMITTED USE, 1934-67.

Public Land Law Review Commission, Washington, D.C.

Max Meyers, and William Folkerts.

Available from NTIS as PB-188 063, \$3.00 in paper copy, \$0.95 in microfiche. Agricultural Experiment Station, South Dakota State Univ., October 1969. 335 p.

Identifiers: *Agriculture, *Economics, *Water supplies, *Law, Terrain, Disposal, Patents, Costs, Reclamation, Control, Intensity, Statistical data, Deserts, Abundance, Classification, Identification, Management planning, Feasibility studies, United States Government, Homestead Acts.

The three working papers treat the related subjects of disposal and use of federal public lands for intensive agriculture. The first paper reports on land disposals in the 17 Western States with primary attention on those during 1934-1966. The second paper summarizes studies of selected cases particularly the administrative procedures and the actual experiences involved. The third paper describes the permitted use in private operators of lands retained in public ownership. (See also W71-01184)
W71-01186

FEDERAL PUBLIC LAND LAWS AND POLICIES RELATING TO INTENSIVE AGRICULTURE. VOLUME IV: WORKING PAPERS: FEDERAL PUBLIC LANDS: ECONOMICS OF FARM SIZE IN WESTERN UNITED STATES.

Public Land Law Review Commission, Washington, D.C.

Available from NTIS as PB-188 064, \$3.00 in paper copy, \$0.95 in microfiche. Agricultural Experiment Station, South Dakota State Univ., October 1969. Various pagings.

Identifiers: *Agriculture, *Economics, *Water supplies, *Law, Terrain, Disposal, Patents, Costs, Reclamation, Control, Intensity, Statistical data, Deserts, Abundance, Classification, Identification, Management planning, Feasibility studies, United States Government, Homestead Acts.

Contents: What is an adequate income for a farm family; The theory; Some simple examples of the effect of output on costs and returns; The homestead in the midwest—is it still adequate; Economics of size of irrigated farms; Economics of size of dryland farms. (See also W71-01184)
W71-01187

GARMANY V SOUTHERN RY (LIABILITY FOR DISCHARGE OF ACCUMULATED SURFACE WATERS).

149 SE 765-776 (SC 1929).

Descriptors: *South Carolina, *Discharge (Water), *Surface drainage, *Relative rights, Diversion, Obstruction to flow, Surface runoff, Drainage, Damages, Remedies, Adjudication procedure, Legal aspects, Judicial decisions, Alteration of flow, Surface waters, Land, Real property, Drainage water, Railroads, Ditches, Flow, Overland flow, Overlying proprietor.

Defendant railroad held a right-of-way upland from plaintiffs' property, and water accumulated thereon. Defendant cut a ditch through a bank which held water on its land, thereby causing the water to flow onto plaintiffs' land. Plaintiffs sought

damages for injury caused by such discharge of the water. Defendant contended that an upper proprietor may be held liable for discharging surface water onto the land of a lower proprietor only where he collects the water and discharges it in a concentrated flow. Defendant contended that there was no evidence that it impounded water and concentrated its discharge onto plaintiffs' property. The Supreme Court of South Carolina affirmed the trial court's judgment for plaintiff, holding that there was ample evidence to suggest impoundment and concentrated discharge of water by defendant. A dissenting opinion emphasized the right of an upland owner to dispose of temporarily accumulated surface water as a common enemy without incurring liability to lower proprietors. (Dye-Fla) W71-01209

MONROE CARP POND CO V RIVER RAISIN PAPER CO (RIPARIAN PROPRIETOR'S RIGHT TO USE STREAM NOT ABSOLUTE).
240 Mich 279, 215 NW 325-328 (1927).

Descriptors: *Michigan, *Riparian rights, *Reasonable use, *Water pollution, Wastes, Legal aspects, Water pollution effects, Judicial decisions, Rivers, Competing uses, Industrial water, Natural use, Relative rights, Riparian land, Riparian waters, Waste disposal, Water utilization, Carp, Fish.

Defendant paper company discharged wastes from its manufacturing plants into a river. Plaintiff, who operated a carp pond near the river below defendant's mills, obtained water for the pond from the river and used the river to transport fish from the pond to a nearby town, brought an action to enjoin defendant's pollution of the river and to obtain damages for the loss of carp. Plaintiff alleged that the wastes affected the oxygen content of the water, thereby causing the death of its fish in the pond and while in transport. Defendant claimed that, as a riparian, its use of the stream was reasonable. The Michigan Supreme Court held that defendant's use of the stream was unreasonable. A riparian proprietor's right to use water in a stream is not absolute. It is a natural right, qualified and limited by existence of a like right on the part of others. (Powell-Florida) W71-01231

OHIO STOCK FOOD CO V GINTLING (STREAM POLLUTION BY UPPER RIPARIAN HOG FARM).
153 NE 341-345 (Ohio Ct App 1926).

Descriptors: *Ohio, *Municipal wastes, *Garbage dumps, *Pollution abatement, Water pollution, Wastes disposal, Legal aspects, Judicial decisions, Streams, Hogs, Riparian water, Riparian land, Riparian rights, Farms, Farm wastes.

Defendant corporation owned a farm one mile from plaintiff's farm. Defendant, under contract with a municipality, received the city's garbage and disposed of it by feeding it to hogs. A stream flowed through defendant's property, then passed through plaintiff's land. Plaintiff brought a nuisance action for damages, alleging that during the operation of its farm, defendant polluted the stream through drainage of liquid, filth and refuse. Defendant contended that its acts in the operation of its farm were authorized by law, inasmuch as it had a contract with a municipality to dispose of the garbage. The Ohio Court of Appeals held that plaintiff was liable for damages, notwithstanding the municipal contract. An upper proprietor of land cannot by artificial means pollute a stream to the injury of a lower riparian owner. (Powell-Florida) W71-01237

ASHLEY V HOLDBERT (LANDOWNER'S LIABILITY FOR ROCKSLIDE DAMAGE CAUSED BY FAILURE TO MAINTAIN CLEAR CHANNEL FOR NATURAL DRAINAGE).
148 Misc 45, 265 NYS 138-141 (1933).

Descriptors: *New York, *Drainage water, *Drainage effects, *Rockslides, Damages, Riddance (Legal aspects), Drainage, Surface runoff, Land management, Topography, Landslides, Remedies, Legal aspects, Judicial decisions, Soil stabilization, Earth materials.

Plaintiff landowner brought action to recover damages caused when a large quantity of stone and soil, from defendant landowner's upper tract, was washed down the natural slope onto plaintiff's lower tract. Plaintiff contended that defendant had placed the rock and soil in the path of the natural flow of rain water and that the draining rain water had carried the materials onto plaintiff's land. Defendant contended that he did not place the stone and soil in the path of the natural drainage and that the rockslide resulted solely from the natural flow of the rain water. The court held that while an upper landowner is not liable for damage caused by rainwater carrying rock or soil from his land onto lower tracts, he is liable if he places soil or rock where natural drainage will carry it to lower tracts. He is also liable if he fails to provide a clear channel for the natural drainage of water from his upper tract. Proof was adequate to support a finding for plaintiff. (Quesada-Florida) W71-01249

NOBLE V ECHO LAKE TAVERN, INC (RIGHT TO DRAW WATER AND TITLE TO LAKE BED: DEED INTERPRETATION).
142 Misc 427, 254 NYS 662-667 (1931).

Descriptors: *New York, *Lakes, *Ownership of beds, *Domestic water, Reasonable use, Boundaries (Property), Non-navigable waters, Riparian rights, Riparian land, Legal aspects, Judicial decisions, Remedies, Water consumption, Beneficial use, Easements, Water utilization, Recreation, Prescriptive rights, Land tenure.

Plaintiff riparian landowner sought an injunction to prevent defendant corporate landowner from taking lake water for other than domestic uses. Plaintiff also sought to have a declaration of his title rights to the bed of the lake. Plaintiff contended that in the deed from himself to defendant's vendor, which conveyed two tracts separated from the lake, he gave only the right to draw water for domestic purposes. Moreover, plaintiff contended, he had conveyed title to only so much of the lake bed as was necessary to lay pipelines for that purpose. Defendant contended that the deed's language, 'and far enough into said pond to furnish water,' gave title to a large part of the bed, the right to draw water for all purposes, and an easement of access to the water. Defendant further claimed: (1) title to the used portion of the bed by adverse possession, and (2) a prescriptive right to the quantity of water it had been drawing. The court held that (1) the deed conveyed only so much of the bed as was necessary to draw water for domestic use, and (2) the words contained in the deed were insufficient color of title upon which to base adverse possession. (Quesada-Florida) W71-01269

HORTON V NIAGARA, LOCKPORT AND ONTARIO POWER CO (EVIDENCE OF HIGH WATER MARK AND TITLE TO BEDS).
231 App Div 398, 247 NYS 756-760 (1931).

Descriptors: *New York, *Boundaries (Property), *Ownership of beds, *River beds, High water mark, Watercourses (Legal), Water level fluctuations, Streamflow, Riparian land, Riparian waters, Banks, Islands, Channels, Vegetation, Legal aspects, Judicial decisions, Remedies, Boundary disputes, Adjudication procedures.

Plaintiff owned land on one side of a certain river. This action was brought to establish title to two pieces of land, one on the opposite bank of the river and the other a part of an island in the river. Defendant hydroelectric company contended that plaintiff's title ran only to the center of the river

and not all the way across to the opposite bank. Defendant also claimed that the part of the island in question was above the high water mark, and thus not within the area originally deeded to plaintiff. The New York Supreme Court, Appellate Division, affirmed a lower court decision for defendant. The court found ancient documents were convincing in showing the boundary of plaintiff's property to extend only to the middle of the river. The evidence also established the existence of an abundance of vegetation indicative that the part of the island in question was above the high water, and thus not owned by plaintiff. (Morris-Florida) W71-01278

BULL V STATE (LOWER PROPRIETOR NOT LIABLE FOR GRADE CHANGES WHICH REPULSE SURFACE WATER).
231 App Div 313, 247 NYS 183-185 (1931).

Descriptors: *Repulsion (Legal aspects), *New York, *Surface waters, *Flood damage, Flooding, Floodwaters, Slopes, Artificial watercourses, Watercourses (Legal), Water control, Grading, State Governments, Highways, Surface drainage, Surface runoff, Remedies, Damages, Legal aspects, Judicial decisions, Surface waters, Relative rights.

Plaintiff landowner sued defendant state for damages caused to his land by flooding after the state constructed a highway and sluiceway. Plaintiff claimed improper construction prevented the natural drainage from carrying waters from a watershed and caused water to back up on his land. Defendant contended that it had a duty to construct and maintain the road, but that it owed no duty to adjacent landowners to allow their surface water to drain onto the highway. The New York Supreme Court, Appellate Division, reversed a lower court decision for plaintiff. The court said the floodwater was surface water, not carried through a natural watercourse, and an adjacent owner is not required to take care of surface waters coming onto his land from the lands of another. A lower proprietor may fill and grade his lands even though the result is to set back surface waters upon his neighbor's land. (Morris-Florida) W71-01282

IBP DESERT RESEARCH UNDERWAY,
For primary bibliographic entry see Field 06A.
W71-01284

KELLOGG V ILLINOIS CENT RR (LIABILITY FOR OVERFLOW OF DRAINAGE DITCH).
239 NW 557-558 (Iowa 1931).

Descriptors: *Iowa, *Drainage, *Ditches, *Overflow, Drainage districts, Administrative agencies, Legal aspects, Judicial decisions, Damages, Watercourses (Legal), Bridges, Streams, Land tenure, Specifications, Crops, Excavation, Abutments, Water injury, Flood damage.

Plaintiff brought suit against defendant railroad company to recover damages to crops resulting from the overflow of a drainage ditch located under defendant's railroad bridge. The ditch was part of a drainage district established upon the petition of defendant. As part of the specifications of the district, defendant was required to raise the elevation of its bridge. Defendant complied with all the specifications called for by the engineer of the drainage district. The trial court dismissed plaintiff's complaint, and the Supreme Court of Iowa affirmed. The court held that since defendant complied with all the specifications of the improvement, plaintiff's suit was barred. (Duss-Florida) W71-01296

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,
Minnesota Univ., Minneapolis. School of Public Health.
For primary bibliographic entry see Field 06B.

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

W71-01300

ALMO WATER CO V JONES (RIGHT TO APPROPRIATE WATER).

39 F2d 37-40 (9th Cir 1930).

Descriptors: *Appropriation, *Prior appropriation, *Diversion, *Water rights, Relative rights, Irrigation, Watercourses (Legal), Utah, Idaho, Rivers, Streams, Water supply, Priorities, Preferences (Water rights), Legal aspects, Judicial decisions, Adjudication procedure, Water quantity.

Plaintiff land company diverted and appropriated river water to irrigate land. Defendants, residents of Idaho and Utah, also claimed the right to use the appropriated water. Plaintiff instituted suit to settle and determine its right to use the water, to quiet title thereto, and to restrain defendants from interfering therewith. The trial court awarded certain defendants some water rights. Appeal was taken by plaintiff water company and by some defendants who were dissatisfied with the lower court's decree. The circuit court affirmed. Evidence showed that plaintiffs and their predecessors in interest had validly appropriated water and had not lost their rights because of adverse use by others. The trial court's reduction of the appropriation of one of the plaintiffs was also supported by the evidence. As to those defendants appealing, it appeared that the award was not an equitable division of the amount of appropriations possessed by them. However, the court held that insurmountable jurisdictional problems prevented it from granting relief. Many claimants were not parties to the appeal, and some claimants could not be given an increase in allowance without giving all claimants an opportunity to present their case. (Duss-Florida)

W71-01302

MANHATTAN OIL CO V MOSBY (LIABILITY FOR POLLUTING STREAM BY ESCAPE OF SALT WATER FROM OIL WELL).

72 F2d 840-847 (8th Cir 1934).

Descriptors: *Saline water, *Water pollution, *Oil wells, *Saline water intrusion, Water pollution sources, Well regulations, Wells, Saline water-freshwater interfaces, Kansas, Judicial decisions, Streams, Encroachment, Fresh water, Water utilization, Impaired water quality, Pollutants, Pollutant identification, Legislation, Water pollution control, Water pollution effects, Legal aspects.

In an action for damages, plaintiff contended that defendant oil drilling company polluted a stream running through plaintiff's ranch by allowing salt water to escape from an embankment at defendant's oil well site. Plaintiff contended that such pollution impaired the water for stock purposes. Defendant contended that plaintiff had failed to allege negligence and thus was precluded from recovering. The court held that a Kansas statute imposed absolute liability upon controllers of oil wells who allow salt water to escape from an oil well site. The court ruled that the fact that the salt water had escaped was a breach of defendant's absolute duty notwithstanding a showing of negligence. Defendant was thus held liable for damages caused by the pollution of the stream. (Snow-Florida)

W71-01303

KENNILWORTH MANAGEMENT CO V CITY OF ITHACA (REFUSAL OF CITY TO SUPPLY WATER UNDER CONTRACT).

313 NYS2d 35-42 (Sup Ct 1970).

Descriptors: *New York, *Cities, *Contracts, *Water supply, Claims (Contracts), Supply contracts, Performance, Contract administration, Municipal wastes, Sewers, Urbanization, Utilities, Public utilities, Water distribution (Applied), Sewage districts, Water allocation (Policy), Water demand, Water requirements, Water resources, Judicial decisions, Legal aspects.

Identifiers: Ithaca (NY).

Plaintiff landowner sought a declaratory judgment to determine whether defendant city could refuse water and sewer service to plaintiff. Plaintiff's property was located in the town of Ithaca, as distinguished from defendant city of Ithaca. Defendant had contracted with the town to supply its residents with water and sewer service. The contract provided that defendant was not obligated to supply water if the supply for its own inhabitants would thereby become insufficient. Defendant relied upon this provision in refusing service to plaintiff. The court held that in such an instance, a municipality not only was not obligated to provide water outside the community, it had a duty not to do so. Plaintiff further asserted that defendant acted arbitrarily and was guilty of laches by permitting the town to lay water mains for plaintiff and then refusing service. The court determined that defendant had acted in good faith in refusing plaintiff service. Plaintiff finally contended that defendant breached the contract by failing to give notice of discontinuance, but the court found that this contract provision only applied to users already receiving water. The action was dismissed. (Hart-Florida)

W71-01307

CITY OF MILWAUKEE V AMERICAN SS CO (PARAMOUNT RIGHT OF THE FEDERAL GOVERNMENT OVER NAVIGATION ON NAVIGABLE WATERS).

76 F2d 343-344 (7th Cir 1935).

Descriptors: *Navigation, *Navigable waters, *Federal government, *Federal jurisdiction, Boats, Harbors, Lakes, Ships, Transportation, United States, Relative rights, Cities, Legislation, Judicial decisions, Governments, Great Lakes.

Plaintiffs, owners and operators of steam vessels engaged in interstate commerce on the Great Lakes, sought an injunction to restrain the City of Milwaukee from enforcing certain ordinances regulating vessels in the harbors of the city. Plaintiff contended that the ordinances, which required the vessels to use tugs while in Milwaukee's harbors, were void as being repugnant to the regulations of the War Department in exercise of the federal government's power over navigable waters. The defendant contended that the regulations of the War Department did not preclude the defendant from also establishing regulations. The court held that the War Department, in establishing comprehensive regulations for the operation of vessels in the navigable waters of Milwaukee harbor, had precluded the enactment of municipal regulations upon this subject. The War Department's regulations, being an exercise of the federal government's paramount right over interstate commerce, indicated that the federal government intended to preempt the area. Defendant was thus restrained from enforcing its ordinances. (Snow-Florida)

W71-01309

STATE EX REL BUCKSON V PENNSYLVANIA RR (OWNERSHIP OF FORESHORE OF NAVIGABLE RIVER).

267 A2d 455-460 (Del 1969).

Descriptors: *Delaware, *Land tenure, *Landfill, *Intertidal areas, Delaware River, Real property, Land use, High water mark, Low water mark, Railroads, State governments, Beaches, Tides, State jurisdiction, Navigable rivers, Navigable waters, Riparian rights, Legal aspects, Judicial decisions.

Plaintiff state sought a declaratory judgment with defendant railroad company to determine the right of defendant to fill in the foreshore of the Delaware River. Defendant, a riparian owner on the Delaware River, diked and filled part of the foreshore. Defendant contended that its title extended to low water mark, and therefore included the foreshore. Plaintiff contended that defendant's title only extended to high water mark. Plaintiff further asserted that filling of the foreshore was prohibited without its permission. The court held

that defendant held title to the low water mark, including the foreshore and that plaintiff's prior consent was unnecessary for defendant to fill its property. The lower court's decision for defendant was affirmed. (Hart-Florida)

W71-01313

MINNIE CREEK DRAINAGE DIST V STREETER (ANNEXATION OF LANDS TO DRAINAGE DISTRICT).

327 111 236, 158 NE 383-386 (1927).

Descriptors: *Illinois, *Drainage districts, *Benefits, *Surface drainage, Surface runoff, Surface waters, Drains, Ditches, Tile drains, Tile drainage, Construction, Discharge (Water), Diversion, Easements, Highways, Legal aspects, Judicial decisions, Watercourses (Legal), Maintenance, Land tenure, Flow, Natural flow doctrine.

Plaintiff drainage district petitioned to annex defendant's lands to its district. Plaintiff alleged that tile drains already drained defendant's land into the district, that defendant's land was benefited by this connection, and that defendant would be benefited in the future by further construction and maintenance of drainage ditches. Defendant denied the connection of her land to district drains or that she or her predecessors had made voluntary application to the district. Defendant alleged her lands were dominant to the district, were adequately drained by natural flow and that she had not diverted water onto the district. The lower court granted plaintiff's petition, and the Supreme Court of Illinois affirmed. The evidence showed that defendant's lands were drained by tile drains to the district several years prior to the petition. State law provides that landowners outside of districts who connect with them shall be deemed to have made voluntary application to be included in such districts. Dominant estates must also assume the burdens of state law when they connect to drainage ditches by artificial means. Furthermore, it is presumed when lands are so connected that they are benefited by the district. (Duss-Fla)

W71-01356

BINGHAM LAND CO V CENTRAL MAINE POWER CO (LIABILITY FOR ALTERING FLOW OF STREAM).

180 A 363 (Me 1935).

Descriptors: *Maine, *Dams, *Streamflow, *Currents (Water), Watercourses (Legal), Flow, Riparian rights, Riparian waters, Streams, Mills, Damages, Legal aspects, Judicial decisions, Alteration of flow, Impounded waters, Impoundments.

Plaintiff upper riparian owner sought damages from defendant lower riparian owner. Defendant had constructed a dam which changed the flow of a stream, which ran through plaintiff's land, from a swift current to pond water. Plaintiff sought damages for destruction by the dam of possible water power development. The commissioners excluded evidence of such damage on the ground that any such loss was not compensable as a violation of a legal right. The Supreme Judicial Court of Maine affirmed per curiam. (Duss-Fla)

W71-01357

INTEGRATING WATER QUALITY MANAGEMENT INTO TOTAL WATER RESOURCES MANAGEMENT IN MINNESOTA,

Minnesota Univ., Minneapolis. Water Resources Research Center.

For primary bibliographic entry see Field 06B.

W71-01358

PERKINS V VERMONT HYDRO-ELECTRIC CORP (LIABILITY FOR FLOOD DAMAGE).

177 A 631-654 (Vt 1934).

Descriptors: *Vermont, *Flood damage, *Flood protection, *Dikes, Floods, Watercourses (Legal), Diversion, Discharge (Water), Damages, Dams, Conduits, Erosion, Rivers, Hydroelectric plants, Obstruction to flow, Maximum probable flood, Sluices, Floodgates, Rainfall, Storms, Ditches, Land tenure, Culverts, Legal aspects, Judicial decisions.

Plaintiff sought damages from defendant hydroelectric corporation for destruction of his property by floodwaters. Plaintiff alleged defendant's negligent construction of a diversion conduit and dike was a cooperative and producing cause of the flood damage. Defendant contended that the flood was of such extraordinary force that it was an act of God. The Supreme Court of Vermont reversed the trial court's judgment for plaintiff. The court ruled that there was sufficient evidence to allow submission to the jury of the question of the adequacy of defendant's construction of the diversion conduit and dike. However, the sufficiency of the dike was not a proper factor in the case since the high water mark of the flood was so much greater than the previous high water mark that any inadequacy in the height of the dike would have had no practical effect on the flood. The court held that it was reversible error for the trial court to fail to instruct the jury on defendant's lack of liability if the damage was independently produced by an act of God. (Morris-Fla) W71-01361

GRAHAM V SAFE HARBOR WATER POWER CORP (DURATION OF FLOOD RIGHTS).
173 A 311-312 (Pa 1934).

Descriptors: *Pennsylvania, *Easements, *Flooding, *Prescriptive rights, Relative rights, Rivers, Watercourses (Legal), Land tenure, Floods, Damages, Legal aspects, Judicial decisions, Adjudication procedure, Dams.

Plaintiffs sought to recover flood damages resulting from defendant corporation's erection of a dam. The original grantor of plaintiffs' land had conveyed floodage rights to the land, and defendant acquired the rights before constructing the dam. Successive conveyances of the land down to plaintiffs contained no reference to the original grant of floodage rights. Plaintiffs alleged that the successive owners of the land had exercised acts of ownership sufficient to extinguish defendant's floodage rights. The trial court directed a verdict for defendant, and the Supreme Court of Pennsylvania affirmed. Plaintiffs' theory was that the acts of ownership constituted adverse possession extinguishing defendant's floodage rights. However, the possession pleaded and proved was not 'adverse' or 'hostile' to defendant. Neither plaintiffs nor their predecessors interfered with the easement conveyed by the original grantor. In some jurisdictions failure to use an easement for a specified length of time will terminate it, but such is not the rule in Pennsylvania. Finally, plaintiffs' contention that defendant's floodage rights were restricted to a small part of the land was a strained interpretation of the original grantor's conveyance. (Duss-Fla) W71-01362

SPECIAL CASES OF WATER SUPPLY INTERFERENCE CAUSED BY URBAN DEVELOPMENT NEAR TORONTO, ONTARIO, CANADA,
Ontario Water Resources Commission, Toronto.
For primary bibliographic entry see Field 02F.
W71-01363

SUMMARY, FEDERAL AGENCY TECHNICAL COMMENTS ON THE SPECIAL TASK FORCE REPORT ENTITLED 'PROCEDURES FOR EVALUATION OF WATER AND RELATED LAND RESOURCE PROJECTS.'
Water Resource Council, Washington, D.C.
For primary bibliographic entry see Field 06B.
W71-01370

VERMONT SHADE ROLLER CO V BURLINGTON TRACTION CO (INTERPRETATION OF WATER RIGHTS UNDER CONTRACT).

150 A 138-147 (Vt 1930).

Descriptors: *Vermont, *Water contracts, *Water control, *Water measurement, Contract administration, Water rights, Discharge (Water), Legal aspects, Judicial decisions, Riparian rights, Riparian land, Riparian waters, Water wheels, Bulkheads, Obstruction to flow, Water levels, Water users, Tailrace, Water demand, Relative rights, Mills, Power operation and maintenance, Weirs.

Plaintiff company and defendant company owned water power rights in a river. A contract had been entered into by the parties' predecessors in 1872 which purported to define the rights of each as to the quantity of water to be utilized for power production. Plaintiff contended it was entitled to as much water as would pass through two openings, each ten inches square with rounded edges. Plaintiff also contended he was entitled to capture and use surplus and flood water in addition to his rights under the contract. Defendant contended plaintiff's rights were limited to those under the contract, and that plaintiff was entitled to that amount of water that would pass through two openings, each ten inches square with square, rather than rounded edges. The court found no facts from which it could fairly infer that rounded edges were contemplated by the parties to the agreement. The court found that square edges on the watergates were contemplated by the parties, and that plaintiff's rights were limited by the language of the contract. Plaintiff's rights were accordingly reduced, and the trial court's judgment for plaintiff reversed. (Price-Florida) W71-01382

VILLAGE OF BRATTLEBORO V YAUVEY (JURISDICTION OF MUNICIPAL COURT TO TRY WATER RIGHTS CASE).
143 A 295-296 (Vt 1928).

Descriptors: *Vermont, *Jurisdiction, *Contracts, *Water users, Land tenure, Reservoirs, Cities, Local governments, Water demand, Water rights, Legislation, Contract administration, Water works, Legal aspects, Judicial decisions, Rent, Water supply.

Plaintiff waterworks owner sought to recover rents allegedly due from defendant for water furnished by plaintiff. Defendant claimed the right to free water based on a contract with plaintiff's predecessor in title. The lower court found for plaintiff. On appeal, defendant contended that the lower court was without jurisdiction to try the case. The Supreme Court of Vermont stated that the right to take water from a reservoir system is in itself an interest in real estate. The court then held that since the issue involved the proving of title to real estate, the municipal court was without jurisdiction. The trial court's judgment for plaintiff was reversed. (Price-Florida) W71-01384

BAUMAN V BARENDREGT (RIPARIAN OWNER'S RIGHT TO USE ENTIRE LAKE).
251 Mich 67, 231 NW 70-71 (1930).

Descriptors: *Michigan, *Ownership of beds, *Riparian rights, *Boundary disputes, Boundaries (Property), Relative rights, Fishing, Water utilization, Boating, Recreation, Beds under water, Riparian land, Watercourses (Legal), Lakes, Remedies, Judicial decisions, Legal aspects.

Plaintiffs, riparian owners on a lake, sought to prohibit defendant from fishing and boating on the lake. Defendant was also a riparian owner on the lake, but plaintiffs claimed that defendant's title to the riparian land gave no ownership to the lake bed and thus no right to use the water. The Supreme Court of Michigan, affirming the trial court's

judgment for defendant, ruled that a grant of riparian land carries title to the center of the body of water fronting on the property and that each riparian owner has the right to fish in any part of the lake. (Barker-Florida) W71-01412

PRESTON V CLARK (UPPER RIPARIAN OWNER'S RIGHT TO MAINTAIN DAM).
238 Mich 632, 214 NW 226-229 (1927).

Descriptors: *Michigan, *Riparian rights, *Prescriptive rights, *Natural flow doctrine, Damsites, Relative rights, Dams, Obstruction to flow, Lakes, Streams, Mills, Surface waters, Water utilization, Dam construction, Flow control, Water control, Water supply, Water levels, Judicial decisions, Legal aspects.

Plaintiff mill owners sought to prohibit defendant upper riparian owner from maintaining a dam on a stream which supplied the power for plaintiffs' mills. Plaintiffs contended that they had acquired a prescriptive right to continued flow of the water at its natural volume. They had depended upon such flow for fifty years, and the dam now severely curtailed the water volume. Defendant argued that plaintiffs were not injured by the dam's existence and claimed the right to maintain the same through his riparian ownership. The Supreme Court of Michigan, affirming the trial decision for defendant, ruled that an upper riparian owner may erect such a dam and, as long as the lower owners are not substantially injured hereby, lower proprietors have no grounds for challenging such an exercise of riparian rights. (Barker-Florida) W71-01413

JOHNSON V CITY OF FAIRMONT (JOINT LIABILITY OF INDEPENDENT POLLUTERS).
247 NW 572-573 (Minn 1933).

Descriptors: *Minnesota, *Water pollution sources, *Remedies, *Adjudication procedure, Path of pollutants, Water pollution, Pollutants, Effluents, Sewage, Cities, Pollutant identification, Streams, Water pollution effects, Odor, Sewage effluents, Wastes, Industrial wastes, Farms, Septic tanks, Waste disposal, Damages, Judicial decisions, Legal aspects.
Identifiers: Fairmont (Minn).

Plaintiff farmer sued defendant city and defendant canning company for damages resulting from each defendant's discharge of pollutants into a stream flowing through plaintiff's land. The sole question on appeal was whether the two defendants could be jointly liable even though their actions were independent. The Supreme Court of Minnesota ruled that where both defendants acted separately and independently of the other, they could not be held jointly liable for damages caused by their acts. The court rejected plaintiff's theory that an implied concert of action arose from each defendant's knowledge of the other's acts. (Barker-Florida) W71-01414

CITY OF CINCINNATI V KIRK (CITY'S LIABILITY FOR POLLUTION FROM SEWAGE SYSTEM).

20 Ohio App 452, 152 NE 207-208 (1925).

Descriptors: *Ohio, *Water pollution sources, *Damages, *Water pollution effects, Cities, Riparian rights, Streams, Effluents, Sewage, Sewage effluents, Water pollution, Impaired water quality, Pollutants, Judicial decisions, Legal aspects.
Identifiers: Cincinnati (Ohio).

Plaintiff landowners sued the City of Cincinnati for damages caused to a stream which ran through plaintiffs' land. Defendant city had constructed a sewage system which emptied into the stream and thus rendered the stream valueless to the riparian owners. The trial jury, based on damages covering

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a five year period, returned an award against defendant city. The appellate court found that full ownership of the property was not in plaintiffs for the entire period and ordered a remittitur of part of the award. The lower court's judgment was affirmed on the question of liability. (Barker-Florida) W71-01415

TICHENOR V WITHERSPOON (LIABILITY FOR DISCHARGE OF POLLUTANTS INTO STREAM).

158 NE 514-516 (Ind Ct App 1927).

Descriptors: *Indiana, *Water pollution, *Saline water, *Alteration of flow, Pollutants, Water pollution effects, Damages, Path of pollutants, Oil wells, Water pollution sources, Oil industry, Streams, Discharge (Water), Riparian rights, Pumping, Judicial decisions, Legal aspects, Overflow, Water injury, Overlying proprietor.

Plaintiff landowner sought damages from defendant for injury to his land resulting from the discharge of large amounts of accumulated salt water and other pollutants into a stream which flowed through plaintiff's land. Defendant operated an oil well on his property and discharged the salt water into a natural watercourse, but claimed that he acted reasonably and with ordinary care to prevent such damage. Plaintiff claimed that the water became polluted, and when the stream overflowed its banks because of the great volume of discharge, his land was made unutilizable. The court ruled that if an upper landowner alters the natural conditions of a watercourse so as to change the course of water, or concentrates it at a particular point, or by artificial means increases its volume, he becomes liable for any injury caused thereby. The trial court's decision for plaintiff was affirmed. (Barker-Florida) W71-01416

MARBA SEA BAY CORP V CLINTON ST REALTY CORP (AVULSION OF BEACH FRONT PROPERTY).

284 (NYS 59-61 (1935).

Descriptors: *New York, *Avulsion, *Beach erosion, *Storms, Beaches, Judicial decisions, Legal aspects, High water mark, Low water mark, Adjudication procedure, Real property, Precipitation excess.

In a per curiam decision in a land partition case, the court held that plaintiff failed to sustain the burden of proving loss of land by avulsion since the testimony offered consisted of approximations and guesses as to the amount of land carried away by several storms and the location of the shoreline in question immediately prior to any one of the storms. Such uncertainty could not support a verdict for plaintiff. (Clark-Florida) W71-01417

BAYORK REALTY CORP V STATE (OWNERSHIP OF ACCRETION).

251 App Div 534, 297 NYS 973-78 (1937).

Descriptors: *New York, *Riparian rights, *Accretion (Legal aspects), *Islands, Boundaries (Property), Boundary disputes, Community development, Judicial decisions, Land tenure, Legal aspects, Proprietary power, Relative rights, Riparian land, Riparian waters, State governments, Currents (Water).

Defendant state appropriated the island in question from a real estate corporation in 1934, based on a map drawn in 1913. During the interim, accretions enlarged the island by 4.07 acres. The corporation subsequently sold this excess acreage to plaintiff. The question was whether defendant owned the whole island or merely that part described in the 1913 map. The court held that slow and imperceptible accretions belong to the riparian owner of

the land to which such accretion attaches. Prior to the corporation's conveyance to plaintiff, it had preferred to defendant a confirmatory deed which recited that such deed conveyed all the corporation's real property located on the island. Based on this statement, the court held that defendant owned the whole island. (Clarke-Florida) W71-01418

SHAPLEIGH V UNITED FARMS CO (BOUNDARY DISPUTE RESULTING FROM AVULSIVE CHANGE IN RIVER CHANNEL).

100 F2d 287-89 (5th Cir 1938).

Descriptors: *Texas, *Avulsion, *Boundary disputes, *Boundaries (Property), Navigable waters, Accretion (Legal aspects), Rio Grande, Channel morphology, Land forming, Legislation, Patents, Meanders, Watercourses (Legal), Judicial decisions, Legal aspects, Real property.

In a consolidated suit in trespass to try title to realty, plaintiff landowners claimed certain lands which they contended were cut by avulsive changes in the river channel from a tract of land given them by the President of Mexico. Defendant landowner claimed title to the lands through a chain of title beginning with patents from the State of Texas. The lands were located at the time of the contest within defendant's boundaries as described in his muniments of title. The court stated that the presumption is in favor of present boundaries, and he who asserts that the channel of a watercourse recognized as the boundary line is not, in fact, at the point in controversy, the true boundary, resting his contention upon a sudden shifting of the course of the channel, assumes the burden of proving that fact. The court held that plaintiffs had failed in their proof, and the judgment for defendant was affirmed. (Price-Florida) W71-01419

WITTMAYER V UNITED STATES (EXCEPTIONS TO THE RULE THAT TITLE TO LAND BOUNDED BY A RIVER GOES TO THE SHORE).

118 F2d 808-11 (9th Cir 1941).

Descriptors: *Montana, *Boundaries (Property), *Boundary disputes, *Eminent domain, Meanders, Accretion (Legal aspects), Condemnation, Dams, Reservoirs, Navigable rivers, Navigable waters, Judicial decisions, Legal aspects, Legislation, Patents, Missouri River, River flow, Low water mark, High water mark, Islands, Floodwaters, Vegetation.

Plaintiff United States instituted suit against defendant landowners to acquire by condemnation lands on an island in the Missouri River for construction of a dam and reservoir project. Defendants contended they should be compensated for the land conveyed to them by patent as well as the land accreted thereto. Plaintiff contended the accreted lands were part of the public domain. Some of the accreted land between the meander line and the river was in existence prior to defendants' homestead entry. The court stated that the boundary of a grant such as defendants' is usually the actual water line and not the meander line. Two exceptions exist, however. Where by reason of fraud or mistake in the survey, there is at the time of the survey a substantial amount of land between the survey line and the actual shore, the meander line is treated as the true boundary. This is true also if between the time of survey and the time of entry, a substantial amount of land was formed between the survey line and the water. The trial court's decision that defendants' boundary was the meander line and that the land in question was public domain was affirmed. (Price-Florida) W71-01420

ISELIN V LA COSTE (OWNERSHIP OF ISLANDS IN NAVIGABLE WATERS).

139 F2d 887-888 (5th Cir 1944).

Descriptors: *Mississippi, *Boundary disputes, *Riparian rights, *Avulsion, Meanders, Boundaries (Property), Federal jurisdiction, Judicial decisions, Legal aspects, Natural flow doctrine, Ownership of beds, Relative rights, Riparian land, Riparian waters, Usufructuary right, Watercourses (Legal), Rivers, Mississippi River, Currents (Water), Accretion (Legal aspects), Channels, Streamflow.

Plaintiff owned land in Louisiana adjacent to the Mississippi River. Due to natural fluctuations in the course of the river channel, part of plaintiff's land became submerged, then reappeared later as an island located on the opposite side of the thread of the channel from plaintiff's land. Plaintiff sought to quiet title to the island. The court stated that under Mississippi law, a riparian proprietor owned to the thread of the stream. Furthermore, when a river forms the boundary between two states, and natural physical changes cause the channel to shift, the new channel becomes the boundary. Where an avulsion occurs because of a flood or freshet, however, causing a sudden change in the course of the stream, the center of the old channel remains the boundary. The facts of this case clearly indicated the former situation and the court affirmed the trial court's judgment for defendant. (Clarke-Florida) W71-01421

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (EXCESSIVE WITHDRAWAL OF WATER FROM RIVER).

166 Misc 10, 1 NYS2d 915-17 (1938).

Descriptors: *New York, *Usufructuary right, *Administrative agencies, *Diversion, Competing uses, Reasonable use, Relative rights, Judicial decisions, Legal aspects, Regulation, Ownership of beds, State governments, Riparian rights, Navigable rivers, Public rights, Patents, Natural flow, Easements, Riparian land, Water rights, Water users.

Plaintiff water commission brought action to enjoin defendant's excessive withdrawal of water from the Niagara River and to determine ownership in the bed and waters of said river. Defendant was a riparian landowner on the Niagara River who claimed the right to divert and utilize the flow of the water by reason of its riparian rights as owner of the banks of the river. Plaintiff alleged that the state was the sovereign and proprietary owner of the bed and waters of the river, and that state statutes giving perpetual grants to defendant of such river's riparian land waters was unconstitutional. The court found that the right of the owner of riparian land to the natural flow of water in a stream adjacent to the land is a corporeal hereditament. Such hereditament is more than an easement; it is a usufructuary right. It is properly classified at common law, equally with the land itself, as real property. The right to the use of the water of a flowing stream, navigable or non-navigable, arises by mere operation of law as incident to the ownership of the bank and is part of the estate of its owner to which plaintiff could not object. (Barnett-Florida) W71-01422

GUCKER V TOWN OF HUNTINGTON (DETERMINATION OF RIGHTS TO SAND BAR IN NAVIGABLE WATERS).

254 App Div 10, 3 NYS2d 788-93 (1938).

Descriptors: *New York, *Cities, *Sand bars, *Accretion (Legal aspects), Navigable waters, Boundaries (Property), Real property, Riparian rights, Landfills, Overlying proprietor, Bays, High water mark, Tidal waters, Dredging, Boats, Riparian land, Ownership of beds.

Identifiers: Huntington (NY).

Plaintiffs brought suit to cancel, as a cloud on title, three quitclaim deeds purporting to release rights in a certain sand bar situated in tidal waters. Plaintiffs also sought relief for the alleged invasion of their riparian rights by defendant city's dredging

and deposit of material on the sand bar which raised its level and made it impassable for small boats. The lower court held for plaintiffs, directing the restoration of the status quo of the sand bar and restoration of other property which the court found defendant to have dealt with unjustly in violation of plaintiffs' rights. The appellate court modified and reversed the lower court's holding, stating that the sand bar was not contiguous to plaintiffs' upland and thus title did not reside in them as the owners of accreted lands adjacent or contiguous to their riparian upland. Title to land under navigable waters, subject to the rights of the public and upland owners was found to reside in the state to the high water mark and not in plaintiffs. In light of such ownership, the court held that defendant had not dealt unjustly with plaintiffs' lands. (Barnett-Florida)

W71-01423

BROWN V STATE (CANAL CONSTRUCTION AS A CONTRIBUTORY CAUSE OF FLOODING).

30 NYS2d 671-72 (1941).

Descriptors: *New York, *Flood damage, *Canal construction, *Rainfall, Damages, Flooding, Floods, Cloudbursts, Floodwater, Rain, Rain water, Canals, Judicial decisions, Locks, Excessive precipitation, Rainfall intensity, Legal aspects, Operation and maintenance.

In an action for damages, plaintiff contended that defendant state was liable for damages for the flooding of his lands along a river between certain state barge canal locks. Plaintiff contended that the barge canal was improperly constructed or negligently maintained so as to maximize the effects of a flood caused by an exceptionally great rainfall. Defendant contended that the sole cause of the flooding was the concentration of rainfall. The court held that testimony supported the finding that the canalization of the river, construction of dams and reservoirs, and deepening, widening and straightening of the river actually lessened the damage from the flooding. Thus, since the barge canal construction was not a contributing cause of the flooding, plaintiff was denied recovery. (Snow-Florida)

W71-01424

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (RIPARIAN RIGHT TO DIVERT THE WATERS OF A NAVIGABLE RIVER).

262 App Div 460, 30 NYS2d 371-78 (1941).

Descriptors: *New York, *Riparian rights, *Diversion, *Water utilization, Riparian land, Riparian waters, Navigable waters, Legislation, Judicial decisions, Relative rights, Severance, Rivers, Navigable rivers, Public rights, Use rates, Administrative agencies, State governments, Usufructuary right, Regulation, Supervisory control (Power).

Plaintiff, a state agency, brought an action for a declaratory judgment to determine if it could require defendant power company to pay a rental for the use of the waters of the Niagara River. Plaintiff contended that the state's conservation law authorized it to collect rental for diversion of the waters of a public navigable river. Defendant contended that the act did not apply to it in that it had a pre-existing right to divert and use the waters of the river. Defendant contended that such right was a common law right of diversion as a riparian owner. The court held that the defendant, as a riparian owner, had the right to divert and use the waters of the river and that such right was subject only to the paramount right of the state to utilize the waters for a public use. The court held that the legislature had not delegated to plaintiff the authority to exercise the state's paramount right and thus defendant's right as a riparian was unaffected. The existence of such pre-existing right precluded the operation of the statute, and thus no rental could be charged. (Snow-Florida)

W71-01425

PEOPLE V STATE TAX COMM'N (VALIDITY OF FRANCHISE ASSESSMENT OF RAILROAD BRIDGE AS AFFECTED BY NAVIGABILITY OF RIVERS).

266 App Div 452, 43 NYS2d 189-92 (1943).

Descriptors: *New York, *Bridges, *Taxes, *Navigable rivers, Navigable waters, Assessments, State governments, Governments, Government finance, Rivers, Railroads, Transportation, Judicial decisions, Legal aspects, Water law, Navigation.

Plaintiff railroad sought to cancel a franchise tax assessment, levied by defendant state tax commission, on plaintiff's bridge over a river. The sole issue was whether the river was navigable at the point of crossing. Plaintiff contended that it was not navigable and therefore not subject to a franchise tax. Defendant contended that the river was navigable. Reversing a judgment for plaintiff, the court held that the river was navigable. The court noted that a stream is navigable if it is capable of floating a single log to market during a part of the year, and even disuse for 100 years does not cause the river to lose its navigable character. One justice dissented. (Liptak-Florida)

W71-01426

SCHROEDER BESSE OYSTER CO V UNITED STATES (DAMAGE TO OYSTER BEDS THROUGH DREDGING).

95 Ct Cl 729-40 (1942).

Descriptors: *United States, *Rivers and Harbors Act, *Commercial shellfish, *Ownership of beds, Boundaries (Property), Federal government, Industries, Judicial decisions, Land tenure, Legal aspects, Legislation, Proprietary power, Damages, Bays, Dredging, Oysters, Channel improvement, Massachusetts.

Pursuant to the Rivers and Harbors Act of 1935, defendant United States commenced and continued dredging operations during the years 1936 and 1937 in the proximity of Onset Bay, Massachusetts. Plaintiff owned certain areas of the bed of Onset Bay on which it was licensed to cultivate and harvest oysters. Mud and silt from the dredging operation killed most of plaintiff's harvestable oysters and rendered the land on which they grew unusable for that purpose. In addition, plaintiff claimed that its recently planted seed oysters, which would have grown into a large crop of harvestable oysters, were also destroyed. The court granted full compensation for damages to the mature oysters and the oyster beds. It refused compensation for the seed oysters, however, holding that their successful maturity into a harvestable crop was speculative, and speculative damages were not allowable under the terms of the act. (Clarke-Florida)

W71-01427

DOONER V UNITED STATES (ARTIFICIALLY INDUCED FLOOD DAMAGE).

95 Ct Cl 392-400 (1942).

Descriptors: *United States, *Community development, *Flood damage, *Canals, Boundaries (Property), Federal government, Judicial decisions, Legal aspects, State governments, Proprietary power, Relative rights, Riparian land, Riparian rights, Riparian waters, Usufructuary right, Watercourses (Legal), Damages, Floods, Cost allocation.

Plaintiffs owned property adjacent to a canal. The State of Illinois undertook to deepen and enlarge such canal, but ran out of funds before the work could be completed. Defendant United States provided the funds and supervision to complete the project. During the course of such construction the water level of the canal was raised, and plaintiffs' lands were completely submerged. The court found from the facts that at the time the state ceased work on the canal, plaintiffs' lands were above water.

Defendant's contribution to the project alone caused the water level to rise and flood plaintiffs' lands. Consequently, plaintiffs were allowed to recover in full the value of their property. (Clarke-Florida)

W71-01428

BRAEBURN ALLOY STEEL CORP V UNITED STATES (GOVERNMENT'S LIABILITY FOR DAMAGES CAUSED BY UNPRECEDENTED FLOOD).

95 Ct Cl 343-57 (1942).

Descriptors: *Historic flood, *Dams, *Subsidence, *Federal government, Washouts, Pennsylvania, United States, Maximum probable flood, Disasters, Flood damage, Dikes, Riparian land, Erosion, Overflow, Floods, Cloudbursts, Governments, Navigation, Damages, Remedies, Eminent domain, Judicial decisions, Legal aspects, Settlement (Structural).

Plaintiff steel company brought action against defendant United States to recover damages resulting when flood waters overflowed defendant's dam and dike, with the result that subsequent erosion caused plaintiff's factory and office building to fall into the river. Plaintiff contended that defendant was negligent in constructing and maintaining an inadequate dam adjacent to plaintiff's riparian property and that the resultant damage was in the nature of a taking of property for a public use. Defendant argued that the flood was unprecedented, that the dam was constructed according to good engineering practice, and that the dam was sufficient to withstand any previously known flood. Noting the distinction between a taking for a public purpose and consequential damage resulting from legitimate governmental activity, the court dismissed plaintiff's claim. (Liptak-Florida)

W71-01429

RODEN COAL CO V UNITED STATES (GOVERNMENT'S LIABILITY FOR SUBSIDENCE DAMAGE CAUSED BY CHANNEL DREDGING).

95 Ct Cl 219-231 (1941).

Descriptors: *United States, *Channel improvement, *Dredging, *Subsidence, Bank erosion, Canals, Canal construction, Navigation, Navigable waters, Piles (Foundations), Sheet piling, Bulkhead line, Bulkheads, Retaining walls, Governments, Compensation, Condemnation, Eminent domain, Damages, Riparian land, Judicial decisions, Legal aspects, Legislation, Coal mines.

Plaintiff coal company brought action against defendant United States to recover for subsidence damage to plaintiff's riparian coal yard. The subsidence was allegedly caused by defendant's adjacent canal-dredging operations. Plaintiff contended that subsidence damage and bulkhead failure caused by defendant's dredging amount to a constructive taking of property under the fifth amendment. Defendant argued that the damage was the consequential result of the government's exercise of its lawful authority to maintain a navigable waterway. The court held that liability did not rest on the government unless specifically authorized, and the act authorizing the dredging did not authorize claims for consequential damage. The court further found that the damage was due to plaintiff's negligence in not providing an adequate bulkhead or sufficient foundations for its coal derricks and other heavy shore equipment. (Liptak-Florida)

W71-01430

MOUNDSVILLE WATER CO V MOUNDSVILLE SAND CO (TRESPASSER'S LIABILITY FOR DAMAGE TO WATER SUPPLY LINE).

19 SE2d 217-221 (W Va 1942).

Descriptors: *West Virginia, *Public utilities, *Water loss, *Water supply, Public rights, Naviga-

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ble rivers, Riparian land, Ownership of beds, River beds, Water pollution, Turbidity, Pumping, Water wells, Water shortage, Pumping plants, Right-of-way, Legal aspects, Judicial decisions, Remedies, Damages, Federal government, State governments. Identifiers: Moundsville (West Virginia).

Plaintiff water company sought an injunction to require defendant sand company to allow it access to a waterline to make repairs. Plaintiff also sought damages. Defendant had driven pilings into the river bank to prevent erosion and one piling had broken a pipeline carrying water from an underwater well to a pumping station, allowing mud to enter the waterline and forcing its disuse. Defendant also had accumulated a large pile of gravel at the river bank which obstructed plaintiff's access to the pipeline. Defendant argued that plaintiff had not received a right-of-way grant for the line. The Supreme Court of Appeals of West Virginia ruled, however, that the line had been there 36 years, giving plaintiff the protection of a license against a trespasser. The court said injury to a utility affecting the public is grounds for an injunction. The court also stated that plaintiff had an easement from a common grantor for access, and ordered defendant to pay for damages resulting from the break in the pipeline up to the time it removed the gravel and repaired the pipeline. (Morris-Florida) W71-01431

OAKWOOD SMOKELESS COAL CORP V MEADOWS (LIABILITY FOR DAMAGE RESULTING FROM NORMAL OPERATION OF COAL MINE).

184 Va 168, 34 SE2d 392-397 (1945).

Descriptors: *Virginia, *Coal mine wastes, *Water pollution sources, Reasonable use, Legal aspects, Judicial decisions, Remedies, Springs, Seepage, Coal mines, Acidic water, Water pollution, Natural flow, Percolating water, Runoff, Mining, Air circulation, Ventilation, Real property, Relative rights.

Plaintiff spring owners sued for damages caused to their spring by polluted water percolating from defendant's coal mine. The property rights of both parties were obtained from a common grantor. Defendant received his lease on mineral rights prior to plaintiff's purchase of his property, and constructed a coal mine which, because of the necessity for ventilation, accumulated water. The water flowed from the mine down a hill, and some seeped into plaintiff's spring. Plaintiff contended that defendant was liable because operation of the mine caused his damages, but defendant insisted that the lease gave him a right to normal operation of a coal mine, including use of natural drainage channels. The Supreme Court of Appeals of Virginia reversed a lower court decision for plaintiff, and held that since the lessor placed no restrictions on normal operation of a coal mine, plaintiff took the deed to his land subject to the defendant's rights. (Morris-Florida) W71-01432

CITY OF ATLANTA V SCOTT (PROPERTY DAMAGE RESULTING FROM STREET DRAINAGE).

18 SE2d 76-80 (Ga Ct App 1941).

Descriptors: *Georgia, *Cities, *Highway effects, *Adjudication procedure, Legislation, Drainage, Judicial decisions, Legal aspects, Highways, Roads, Damages, Drains, Local governments, Grading, Real property, Surface drainage, Erosion, Drainage water, Paving, Ponding, Surface waters, Effects, Remedies, Road construction. Identifiers: Atlanta (Georgia).

Defendant city paved and graded a street adjacent to plaintiff's property. Plaintiff contended that the grading resulted in the diversion of large amounts of surface water onto her property and caused damage to her house and grounds. Plaintiff further contended that the drains installed by defendant

were inadequate and that cracking of one drain resulted in further damage to her property. Defendant contended that the complaint failed to allege notice to the city within 90 days of the damage as required by statute. However, the trial court overruled defendant's demurrer on this ground. The Court of Appeals of Georgia reversed. Georgia statutes require that notice must be given the city within 90 days from the infliction of injury before suit can be brought. The city's demurrer should have been sustained. (Dye-Florida) W71-01433

PERRY V MORGAN (TITLE TO LANDS UNDER STATE GRANT).

219 NC 377, 14 SE2d 46-49 (1941).

Descriptors: *North Carolina, *Navigable waters, *Real property, *Land tenure, Governments, Navigation, Land, Streams, State governments, Judicial decisions, Legal aspects, Ownership of beds, Beds under water, Boundaries (Property), Running waters, Rivers, River beds, Bodies of water, Streambeds, Islands, Dredging.

The United States government dredged earth from a channel, depositing it on and enlarging an existing island. Plaintiff claimed title to the land under a 1937 grant from the state. Defendant contended that the newly created land fell within the bounds of a grant to defendant's successor in title in 1853. Plaintiff contended that: (1) parol evidence could not be admitted to interpret defendant's alleged grant; and (2) the land in question was covered by navigable water and was thus not subject to grant. The trial court excluded defendant's evidence as to both contentions and ruled for plaintiff. The Supreme Court of North Carolina reversed. Any ambiguity in defendant's grant was latent, and parol evidence should have been admitted to clarify the grant. Moreover, sufficient evidence was offered to present a proper question to the jury as to whether the property was covered by navigable waters at the time of defendant's grant. The existence of the grant was evidence of the non-navigability of the stream. (Dye-Florida) W71-01434

LAWRENCE V CITY OF LA GRANGE (DAMAGES RESULTING FROM CITY DRAINAGE FACILITIES).

11 SE2d 696-699 (Ga Ct App 1940).

Descriptors: *Georgia, *Drains, *Erosion, *Damages, Legal aspects, Judicial decisions, Cities, Local governments, Real property, Drainage, Drainage effects, Drainage water, Pipes, Excess water (Soil), Surface runoff, Eminent domain, Remedies, Diversion, Floods, Surface drainage, Value, Land appraisal, Adjudication procedure.

Defendant city constructed drainpipes on plaintiff's property which caused erosion to plaintiff's land and consequent depreciation in the rental value of the property. Plaintiff contended that the pipes constituted a continuing nuisance for which defendant was liable. The Court of Appeals of Georgia stated three grounds under which defendant could be held liable: (1) if defendant's construction or maintenance of the drainage pipes was negligent; (2) without regard to negligence, if plaintiff's life or health was endangered; and (3) under the Georgia constitution, if defendant's actions constituted a taking of private property without compensation. As to the first two grounds, plaintiff alleged in her complaint neither negligence nor danger to her life and health. Plaintiff's suit was brought more than four years after the construction of the pipes, thus the statute of limitations barred action under the constitutional provision governing uncompensated taking of private property. The court affirmed the trial court's dismissal of plaintiff's complaint. (Dye-Florida) W71-01435

CITY OF ROME V BROWN (DAMAGES FOR PONDING CAUSED BY MUNICIPAL IMPROVEMENTS).

190 SE 787-789 (Ga 1937).

Descriptors: *Georgia, *Cities, *Natural flow doctrine, *Obstruction to flow, Flooding, Flood damage, Ponding, Damages, Water injury, Mosquitoes, Public health, Judicial decisions, Legal aspects, Adjudication procedure, Relative rights, Surface runoff, Surface drainage. Identifiers: Rome (Georgia).

Plaintiff municipal property owner sued defendant city for damages resulting from defendant's alteration of the street and curb level in front of plaintiff's property. Defendant had raised the street and sidewalk level 14 inches, creating a dam effect and preventing natural drainage of surface water from plaintiff's lot. The standing water caused the floors in plaintiff's house to rot and proliferated mosquitoes. Plaintiff contended that defendant's acts were negligent and created a nuisance. The court stated that when a city, in constructing a public improvement, obstructs the natural drainage of surface water, thus creating a pond upon contiguous land without providing other drainage, it is liable for damages. The court noted that defendant might also be held liable for nuisance. Finding that the lower court had properly overruled defendant's demurrer, the court affirmed the judgment for plaintiff. (Hart-Florida) W71-01436

HAMPTON V TOWN OF SPINDALE (DISCHARGE OF INDUSTRIAL WASTES INTO MUNICIPAL SEWER SYSTEM).

210 NC 546, 187 SE 775-777 (1936).

Descriptors: *North Carolina, *Cities, *Industrial wastes, *Water pollution, Chemical wastes, Industrial plants, Soil contamination, Water pollution sources, Municipal water, Impaired water quality, Pollutants, Public health, Water pollution effects, Odor, Domestic wastes, Municipal wastes, Sewers, Sewage disposal, Judicial decisions, Legal aspects, Adjudication procedure, Waste disposal.

Plaintiff landowner sued defendant city and mill and power companies for damages resulting from pollution of a stream running through plaintiff's land. The mill and power companies discharged industrial wastes into the municipal sewer system which in turn discharged into the stream. Defendant city owned and completely controlled its sewer system. Noting that persons on whose initiative a sewer system is constructed are not liable for its use after the municipality assumes control, since the proximate cause of the damage is not construction but operation of the sewer, the court held that the mill and power companies were not liable to plaintiff. Plaintiff submitted a voluntary nonsuit as to defendant city. (Hart-Florida) W71-01437

CITY OF ROME V BROWN (DAMAGES FOR PONDING CAUSED BY MUNICIPAL IMPROVEMENTS).

186 SE 708-710 (Ga Ct App 1936).

Descriptors: *Georgia, *Cities, *Natural flow doctrine, *Obstruction to flow, Flooding, Flood damage, Ponding, Damages, Water injury, Judicial decisions, Legal aspects, Adjudication procedure, Surface runoff, Surface drainage. Identifiers: Rome (Georgia).

Plaintiff property owner sued defendant city for damages resulting from defendant's alteration of the street and curb level in front of plaintiff's home. Defendant had raised the street and sidewalk level 14 inches, creating a dam effect and preventing natural drainage. The standing water caused plaintiff's house to begin to rot. Plaintiff contended that defendant's acts were negligent and created a nuisance. The court stated that when a city, in mak-

ing public improvements, obstructs natural flow of surface water without providing an outlet, it becomes liable in damages. The court stated also that if the ponding created a nuisance, the city could be held liable. The decision of the lower court for plaintiff was affirmed. (Hart-Florida) W71-01438

CUNNINGHAM V PREVOW (TITLE TO PROPERTY FORMED BY ACCRETION).

192 SW2d 338-352 (Tenn Ct App 1945).

Descriptors: *Tennessee, *Accretion (Legal aspects), *Land tenure, *Riparian land, Bank erosion, Boundaries (Property), Rivers, Avulsion, Legal aspects, Judicial decisions, Boundary disputes, Relative rights, Channels, Channel erosion, Riparian rights, Real property, Erosion, Banks.

Plaintiff and defendant both claimed title to land which had re-formed by accretion in an area formerly occupied by plaintiff, but which had previously been eroded away by changes in a certain river's channel. The temporary channel abutted on defendant's property, and when the river gradually moved back to its original channel, defendant claimed that the portion of the plot accreting onto his property belonged to him. Plaintiff argued that land formed by the process of accretion in place of land lost by erosion was regained to the owner of the land that was washed away. The court rejected this contention, holding that where land bordering on a stream is washed away and an accretion to the land of another subsequently extends over the same place, the naturally formed land belongs to the owner of the land to which it is an accretion, and not to the one originally owning the land in that place. Prior cases to the contrary were distinguished as dealing largely with avulsion, and the trial court's decision for the plaintiff was reversed. (Caldwell-Florida) W71-01439

KENTON V MASSMAN CONST CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF A DIKE).

164 SW2d 349-353 (Mo 1942).

Descriptors: *Missouri, *Dikes, *Flood damage, *Construction, Legal aspects, Flooding, Flood control, Navigable rivers, Missouri River, Judicial decisions, Engineering structures, Diversion structures, Remedies, Concrete structures, Channel width, State governments, Federal government, Supervisory control (Power).

Plaintiff landowner sued defendant construction company for damages caused to plaintiff's land and crops by flooding which resulted from defendant's construction of a dike in the Missouri River. Plaintiff contended that defendant had extended the dike too far across the river and failed to leave the customary channel width according to government regulations. Plaintiff further contended that a screen mat was attached to the dike which was not authorized by the United States in the construction contract and that this mat was the cause of the flooding since it obstructed the flow of water. Defendant contended that the United States had authorized the work at defendant's specification and that defendant had constructed the dikes under the supervision and by the approval of the Corps of Engineers. The Supreme Court of Missouri held that plaintiff failed to prove that defendant had negligently constructed the dike in violation of its contract with the United States. (Quesada-Florida) W71-01440

MISSOURI PAC RR V SALE (VESTED LAND RIGHTS SURVEYED AND DISPOSED OF BY FEDERAL GOVERNMENT NOT AFFECTED BY RE-SURVEY).

127 SW2d 133-135 (Ark 1939).

Descriptors: *Arkansas, *Surveys, *Public lands, *Patents, Reclamation, Federal reclamation law, Public rights, Governments, Legal aspects, Judicial decisions, Swamps, Land reclamation, Accretion (Legal aspects), Proprietary power, Leases, Relative rights, Riparian rights, Riparian land, Water rights, Real property.

According to an 1845 United States survey, appellee's land, located in a river bend, consisted of 97 acres. A 1929 re-survey listed 160 acres in the same tract. The discrepancy was caused either by an initial recordation error or by accretion. Subsequent to the re-survey, the General Land Office issued appellant railroad company a patent covering appellee's land, including the increased acreage. The Commissioner of the General Land Office overruled appellee's protest of appellant's claim to the land. Appellee then brought an action against a lessee, whose tenancy had terminated, to recover possession of said land. Appellant intervened, claiming title to the land. The Supreme Court of Arkansas, in affirming the lower court's judgment, held that where appellee's vested rights had been acquired under an 1845 survey, a 1929 re-survey of the same tract was void. Therefore, the General Land Office was without authority to grant appellant a patent under the later survey, notwithstanding the fact that the later survey showed increased acreage. (Powell-Florida) W71-01441

HAUPT V PRUSE (BOUNDARY DISPUTE FOLLOWING SHIFT IN CHANNEL OF RIVER).

277 Ky 120, 125 SW2d 782-784 (1938).

Descriptors: *Kentucky, *Patents, *Islands, *Boundaries (Property), Rivers, Boundary disputes, Bayous, Meanders, Legal aspects, Judicial decisions, Accretion (Legal aspects), Bodies of water, Ponds, Streams, Navigable rivers, Land, Land tenure, Real property.

Identifiers: *Sloughs.

A 1796 patent described a large island as bounded on the north by the Kentucky River. An 1858 patent described a smaller island which was located to the north of the large island. The thread of the Kentucky River, which at the time of trial ran to the north of the smaller island, previously ran along a slough between the two islands. Appellees, heirs of the 1858 patentee, brought an action for the sale of the smaller island and for a division of proceeds. Appellant, owner of the large island, intervened. Appellant contended that the 1796 patent included the smaller island since the norther boundary of the larger island was the Kentucky River as it ran at the time of trial. Appellee contended that the boundary line quoted from the 1796 patent was intended to follow a slough in which the Kentucky River formerly ran, and that the smaller island lay between the slough line and the river. The Kentucky Court of Appeals, in affirming a judgment for appellee, held that the evidence supported a finding that the smaller island was not included in the 1796 patent. (Powell-Florida) W71-01442

GENERAL AMERICAN LIFE INS CO V DUNKLIN COUNTY (PATENT OF SWAMPLAND TO STATE).

96 SW2d 380-384 (Mo 1936).

Descriptors: *Missouri, *Swamps, *Land reclamation, *Drainage, Legal aspects, Judicial decisions, Remedies, Federal government, State governments, Local governments, Legislation, Ownership of beds, Boundaries (Property), Patents, Beds under water, Water policy, Drainage programs, Land use, Reclamation states, Real property.

Plaintiff corporation sought to be declared owner of former swampland which a predecessor-in-title allegedly had purchased from defendant county. The land was allegedly granted to the state from the United States by an 1850 act of Congress, which

the state in 1853 granted to the county, which in turn sold it to a predecessor in plaintiff's chain of title. The court found, however, that fee simple title did not actually pass from the county to the predecessor because the land was not accurately plotted until 1933. Therefore, the congressional act did not patent the land to the state until then. The state again transferred its patent to the county in 1934. The court held the land was granted from the federal government to the state and thence to the county and plaintiff's predecessor in the 1850s, and the title available after the patent was issued in 1933 became perfect retroactively as of the date of the original grant. The plaintiff had beneficial title between 1850 and 1934, and the subsequently perfected fee simple title related back to the date of the original transfers. (Morris-Florida) W71-01443

MIAMI CORP V STATE (STATE OWNERSHIP OF PROPERTY OF LAND SUBMERGED BY EROSION AND SUBSIDENCE).

186 La 784, 173 So 315-343 (1937).

Descriptors: *Louisiana, *Boundary disputes, *Bank erosion, *Ownership of beds, Accretion (Legal aspects), Boundaries (Property), Real property, Land tenure, Riparian land, Riparian rights, State governments, Navigable rivers, Navigable waters, High water mark, Lakes, Streams, Judicial decisions, Legal aspects, Water law, Legislation, Public lands, Subsidence.

Plaintiff riparian owner brought an action against defendant state to establish the boundary of plaintiff's property, a portion of which had become submerged as a result of gradual erosion and subsidence. Plaintiff claimed title up to the boundary as it existed when he purchased the land and contended that a statute vesting title in the state to beds of navigable rivers did not apply since his land was on a lake. Defendant contended that the bed of all navigable waters belonged to the state and that plaintiff's land was on a lake in name only, the 'lake' being merely a wide section of a river. Overruling precedent to the contrary, the court affirmed a judgment for defendant and held that, since plaintiff's land was now submerged, it was obviously part of the lake bed and therefore public property. The court noted that such a result was dictated by public policy and that plaintiff's loss was offset by the possibility of the situation being reversed by accretion. Two justices dissented. (Liptak-Florida) W71-01444

STATE EX REL RICE V STEWART (TITLE TO BEDS OF NAVIGABLE STREAMS).

184 So 44-52 (Miss 1938).

Descriptors: *Mississippi, *Ownership of beds, *Navigable waters, *Inlets (Waterways), Streambeds, Rivers, Navigation, High water mark, Riparian rights, Public rights, Riparian land, Legal aspects, Damages, Judicial decisions, Federal government, State governments, Governments, Navigable rivers, Streams, River beds, Tidal waters, Mississippi River, Estuaries, Tides.

Defendants, riparian owners of property on a navigable inlet of the Mississippi River, removed sand and gravel from the bed of the inlet. Plaintiff state sought damages to the value of the gravel removed, contending that the bed of a navigable stream where the tide ebbs and flows is held in trust for the public by the state and that, as trustee, the state may bring an action for trespass on behalf of the public. Defendants contended that the rule governing navigable rivers above the tide's ebb, vesting title to streambeds in riparian owners, applied to waters where the tide ebbs and flows as well. The Supreme Court of Mississippi, recognizing that a rule applied in some states treats all navigable waters in the same fashion, applied the rule of the forum and common law, holding title in streambeds to be in the state. The court further held that the state was entitled to any remedy open to a common trustee and could maintain an action

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for trespass. Damages were to be assessed to the value of the property removed, without allowance or deductions for labor or expenses incurred in removing it. (Dye-Florida)
W71-01445

CASSO V ASCENSION REALTY CO (DISPUTE AS TO OWNERSHIP OF BOTTOM LAND AND SURROUNDING WATERFRONT PROPERTY).
190 So 198-204 (La Ct App 1939).

Descriptors: *Louisiana, *Ownership of beds, *Boundary disputes, *Boundaries (Property), Navigable waters, Riparian rights, Judicial decisions, Beds under water, Harbors, Patents, Remedies, Saline water, Tidal waters, Beds, Real property, Land tenure, Legal aspects.

Plaintiff vendee sought to have himself recognized as full owner of the bed of a small port and some of the surrounding waterfront realty. In addition, plaintiff sought to have defendant realty company's possessory action barred. Plaintiff contended that he had acquired title from a vendor whose husband acquired a patent to the land in question from the State of Louisiana. Defendant contended that it had title through the devisee of a claimant prior to the issuance of the patent in plaintiff's chain of title. Moreover, defendant contended that the holder of the patent in plaintiff's chain of title had entered into a compromise with the original grantor in defendant's chain of title by which the holder of the patent relinquished all claims to the bottom land and waterfront realty in question in exchange for other lands. Court of Appeal of Louisiana held that defendant's chain of title was the true one by reason of the compromise entered into by the husband of plaintiff's vendor. (Quesada-Florida)
W71-01446

FLORIDA EX REL MYERS V CONE (LEASING SALT WATER BEDS).
190 So 698-701 (Fla 1939).

Descriptors: *Florida, *Leases, *Saline soils, *Legislation, Saline water, Public rights, Legal aspects, Judicial decisions, Ownership of beds, Riparian rights, Navigable waters, Tidal waters, Oysters, Commercial shellfish, Administrative agencies, Administrative decisions.

Relator applicant sought a writ of mandamus to compel respondent State Board of Conservation to lease certain salt water bottoms to him as required by the provisions of a Florida statute. Respondent contended that the statute under which relator claimed the rights to the lease was superseded by a later statute. Relator contended that the statute providing that the first applicant for a lease on salt water bottoms for oyster beds must be given the lease if qualified unless the other applicants were the riparian owners was not superseded. The Supreme Court of Florida held that the later statutes defining the powers of the State Board of Conservation in no way superseded or repealed the statute in question, and hence relator was entitled to the lease upon proof of the alleged facts. (Quesada-Florida)
W71-01447

MILLER V BAY-TO-GULF, INC (BOUNDARY DISPUTE OVER BEACHFRONT PROPERTY).
193 So 425-429 (Fla 1940).

Descriptors: *Florida, *Riparian land, *Boundary disputes, *Tides, Intertidal areas, Moon, Sea level, Tidal waters, High water mark, Low water mark, Boundaries (Property), Bank erosion, Bulkheads, Retaining walls, Riparian rights, Beach erosion, Erosion control, Riparian waters, Legal aspects, Judicial decisions, Adjudication procedure.

Plaintiff landowner sought an injunction to restrain defendant corporation from demolishing plaintiff's bulkhead, and sued to quiet title to certain beachfront property. Defendant had conveyed a lot

to plaintiff near the beachfront; plaintiff erected two bulkheads between this lot and the Gulf of Mexico to prevent erosion. Defendant sought to convey the strip between plaintiff's lot and the gulf, and wished to remove the bulkheads. Plaintiff contended among other things that since erosion of the beach had caused the high water mark to reach plaintiff's lot, title to the strip sought to be conveyed by defendant was vested in him. The court stated that plaintiff would be entitled to riparian rights if the ordinary high tide extended to his boundary, noting that claim of title because of erosion by tidal waters must be strictly construed. The court held that ordinary high tide did not refer to monthly spring tides, but to the limit reached by the daily usual tide, or the neap tide between the full and change of the moon. Since the lower court's finding that the ordinary high tide had not reached plaintiff's land was not clearly erroneous, the court affirmed the lower court's decision for defendant. (Hart-Florida)
W71-01448

IN RE VICKSBURG BRIDGE AND TERMINAL CO (CORPORATIONS ABILITY TO MORTGAGE BRIDGE CONSTRUCTED ON STATE-OWNED RIVERBED).
22 F Supp 490-507 (SD Miss 1937).

Descriptors: *Louisiana, *Ownership of beds, *Public rights, *Bridges, Mississippi, Judicial decisions, Legal aspects, Railroads, Concrete structures, Navigable rivers, River beds, Boundaries (Property), Transportation, Public benefits, Legislation, Financing, State governments.

Intervenor creditors in a bankruptcy action against defendant bridge company sought to attack the validity of the claims of other creditors. Intervenor contended that defendant could not mortgage a certain bridge because it was constructed on beds to which the state held title in trust for the public. The bondholders and other creditors contended that the State of Louisiana authorized the construction of the bridge for the public benefit and authorized the mortgaging of the structure. The court held that the bridge company had properly complied with Louisiana statutory provisions for the construction of the bridge and for permission to mortgage the structure, and therefore the mortgage was valid. (Quesada-Florida)
W71-01449

THE SS NEA HELLIS (FINES FOR DISCHARGING OIL INTO NAVIGABLE WATERS).
32 F Supp 115-116 (SD NY 1940).

Descriptors: *Oil, *New York, *Ships, *Legislation, Water pollution, Water pollution control, Navigable waters, Coasts, Oil wastes, Water pollution sources, Admiralty, Legal aspects, Judicial decisions, Pollutants, Fuels, Oily water, Federal government, Water law, Harbors, Adjudication procedure.
Identifiers: *Oil Pollution Act, *New York Harbor Act.

The United States brought a libel action in admiralty against defendant steamship to impose a fine for discharging oil into New York Harbor. The action was brought under the Oil Pollution Act of 1924 which prohibited the discharge of oil into the coastal navigable waters of the United States. Defendant contended that the Oil Pollution Act did not apply to the alleged violation. Instead, defendant contended that the alleged violation was governed solely by the New York Harbor Act of 1888 which prohibited discharge of oil into the waters of the harbor of New York. It was agreed that both federal statutes applied to the same subject matter. Under the principle that where there are two statutes upon the same subject—the earlier being special and the later general—the special serves as an exception to the general, the court held that the Oil Pollution Act was not applicable. The New York Harbor Act was a special statute and as such was controlling over the Oil Pollution Act.

Action under the Oil Pollution Act was thus dropped. (Snow-Florida)
W71-01450

SIMMONS V UNITED STATES (LIABILITY FOR FLOOD DAMAGES CAUSED BY CONSTRUCTION OF A DAM).

32 F Supp 302-303 (WD Ky 1940).

Descriptors: *Kentucky, *Dams, *Flooding, *Gradually varied flow, Damages, Engineering structures, Overflow, Rivers, River flow, Flow, Floods, Navigable rivers, Ohio River, Obstruction to flow, Alteration of flow, Silts, Federal government, United States, Judicial decisions, Condemnation, Compensation.

Plaintiff brought an action to recover the value of his land allegedly taken by the United States. Plaintiff contended that the United States had constructed a dam on the Ohio River which resulted in his land on the Salt River, a tributary of the Ohio River, being flooded. Plaintiff contended that the fifth amendment required just compensation for such taking. Defendant contended that the flooding was not the immediate result of the erection of the dam so as not to be within the meaning of 'taking' under the fifth amendment. The court found that the flooding was not the immediate result of the erection of the dam since the dam merely stopped the flow of the Salt River which permitted debris and silt to accumulate and fill the river channel. After a period of time, this accumulation caused the river to overflow its banks. The court held that the taking was gradual rather than immediate, and as such did not constitute a taking for which compensation was required. (Snow-Florida)
W71-01451

KUHNERT V UNITED STATES (FLOOD DAMAGES FROM RIVER OVERFLOW CAUSED BY DIKE CONSTRUCTION).
36 F Supp 798-804 (WD Mo 1941).

Descriptors: *Ice jams, *Dikes, *Overflow, *Navigation, Flood damage, Navigable rivers, Navigable waters, Rivers, Engineering structures, Barriers, Diversion structures, River training, Damages, Flooding, Floods, Riverflow, Flow, Flow around objects, Natural flow, Obstruction to flow, Judicial decisions, Legal aspects, Federal government.

Plaintiff brought an action against the United States for damages from flooding. Plaintiff contended that defendant had defectively constructed a dike on the Missouri River in that the dike extended so far out into the river as to greatly narrow the river's channel and impede the river's flow. Floating ice jammed the river at that point and dammed the water, causing the river's level to be raised and overflowing plaintiff's farm. Defendant contended that the dike was constructed pursuant to the government's power to improve navigation of navigable waters and that the dike was not constructed negligently. From the evidence the court found that the dike was constructed in a careful and prudent manner. The best engineering principles had been applied, and it was unforeseeable that the overflow would result. Accordingly, the court ruled for the plaintiff. (Snow-Florida)
W71-01452

SOUTH CAROLINA EX REL MAYBANK V SOUTH CAROLINA ELEC AND GAS CO (JURISDICTION OVER NAVIGABLE WATERS).
41 F Supp 111-119 (ED SC 1941).

Descriptors: *United States, *Federal government, *Federal jurisdiction, *Navigable waters, Judicial decisions, Jurisdiction, Legal aspects, Legislation, State governments, Water contracts, Contracts, Watercourses (Legal), Canals, Adjudication procedure.

Action was brought by plaintiff state against defendant corporation for breach of contract for defendant's failing to keep a canal open for navigation. Defendant petitioned to have the case heard in federal court on the grounds that the canal was navigable, and thus subject to federal jurisdiction. In dismissing the action, the court held that the question of navigability is not a federal question in the jurisdictional sense, and the fact that a body of water is found to be navigable will not automatically give federal courts jurisdiction of matters in litigation concerning it. (Clarke-Florida) W71-01453

UNITED STATES V THE DELVALLE (UNINTENTIONAL WATER POLLUTION BY UNUSED FUEL OIL).
45 F Supp 746-748 (ED La 1942).

Descriptors: *Legislation, *Navigable rivers, *Ships, *Water pollution sources, United States, Admiralty, Federal government, Federal jurisdiction, Legal aspects, Judicial decisions, Relative rights, Navigable waters, Fuels, Oil wastes, Pollutants, Coasts, Oily water, Regulation, Rivers and Harbors Act.

Defendant ship was prosecuted in rem under a federal statute making it unlawful to discharge refuse in the navigable waters of the United States. One of defendant's employees had negligently left a fuel valve slightly open, causing a fuel tank to overflow and discharge fuel oil into the Mississippi River. The court held that unused valuable fuel oil was not refuse in the ordinary meaning of the word, and the unintentional discharge thereof into navigable waters did not come within the meaning of the statute. (Clarke-Florida) W71-01454

SOUND MARINE AND MACHINE CORP V WESTCHESTER COUNTY (INTERFERENCE WITH RIGHT OF ACCESS TO AND FROM NAVIGABLE WATERS).
45 F Supp 980-983 (SD NY 1942).

Descriptors: *New York, *Access routes, *Navigable waters, *Riparian rights, Navigation, Depth, Riparian waters, Harbors, Riparian land, Judicial decisions, Channels, Pipes, Pipelines, Damages, Beds, Beds under water, Boats, Relative rights.

In an action in admiralty to recover damages, plaintiff corporation, owner of property abutting the waters of a harbor, contended that defendant had laid a sewer pipeline across the channel in the water in front of its property which damaged the property by decreasing the depth of the channel. Defendant contended that only nominal damages were due in that the decrease in depth of the channel in no way materially altered the value of the property. The court held that plaintiff, being a riparian owner, had the right to access to and from the navigable waters adjacent to its property and that defendant's improperly constructed pipeline was a trespass upon such right to access for which damages were due. However, the court ruled that the decrease in depth was not sufficient enough to prevent boats from docking at plaintiff's property. Thus only nominal damages were assessed. (Snow-Florida) W71-01455

CITY OF GREENVILLE V MILLER (RIGHT OF STATE TO TAX INTERSTATE BRIDGE).
47 F Supp 344-350 (ED Ark 1942).

Descriptors: *Arkansas, *Bridges, *Mississippi River, *Taxes, Tariff, Costs, Cities, Administrative agencies, Administration, Regulation, Navigable rivers, Streams, Bridge construction, Financing, Operating costs, Highways, Federal government, Eminent domain, Easements, Right-of-way.

Plaintiff, a city located in Mississippi, brought suit for a declaratory judgment as to the claimed right

of the State of Arkansas to tax plaintiff for that portion of the Greenville Bridge lying within the State of Arkansas. The bridge was built pursuant to congressional authorization as required for all bridges spanning navigable streams. The act of authorization fixed the terms under which it was built, all of which were for a public purpose. Under article 16 par. 5 of the Arkansas constitution, public property used exclusively for a public purpose is exempt from taxation. The court stated that the fact that plaintiff city was an arm of the State of Mississippi and was exercising governmental functions under authority of that state was not controlling. All the facts and circumstances showed that the bridge was used exclusively for a public purpose, and therefore Arkansas was without authority to assess taxes upon that portion of the bridge lying within its boundaries. (Barnett-Florida) W71-01456

UNITED STATES V WEST VIRGINIA POWER CO (VALUATION OF PROPERTY CONDEMNED FOR DAM SITE).
56 F Supp 298-304 (SD W Va 1944).

Descriptors: *West Virginia, *Damsites, *Condemnation value, *Navigation, Sites, Engineering structures, Flood control, Reservoirs, Water control, Condemnation, Eminent domain, Compensation, Flow, River flow, Riparian rights, Navigable rivers, Rivers, Navigable waters, Federal government, United States, Judicial decisions, Reservoir sites, Dams.

In a condemnation proceeding by the United States to acquire lands for a reservoir to be created by the erection of a dam for flood control purposes, condemnnee property owner contended that it had the right to compensation for its land on the basis of a valuation of the land for water power and damsite purposes. The United States contended that the dam was constructed pursuant to the government's power to control navigation on navigable waters, and as such it possessed a dominant easement in the flow of the water at the damsite so as to preclude a riparian landowner from having any benefits of the water flow for which compensation would be due. The court held that the dam constructed for flood control purposes was done pursuant to the plenary power of the government to control navigation. By the exercise of such power, the government asserted its dominant right to the water's flow and as such the riparian owner could properly be excluded from any benefits of such flow without compensation. Thus the value of the land as a damsite locality was not to be considered in the condemnation award. (Snow-Florida) W71-01457

NORTHERN N H LUMBER CO V NEW HAMPSHIRE WATER RES BD (RIGHT TO USE RIVER FOR TRANSPORTATION OF TIMBER).
56 F Supp 177-181 (D NH 1944).

Descriptors: *New Hampshire, *Non-navigable waters, *Lumber, *Dams, Transportation, Navigable rivers, Navigable waters, Rivers, Navigation, Upstream, Damsites, Barriers, Judicial decisions, Federal government, Federal jurisdiction, State jurisdiction, Federal-state water rights conflicts, Administrative agencies.

In an action for damages, plaintiff contended that the state had constructed a dam across a river which prevented him from using the river for transporting timber. Plaintiff contended that the river was a navigable one, and as such any obstruction to it had to be authorized by Congress. Plaintiff contended that the state had not gotten such authorization and therefore had committed a wrong for which he was entitled to recover damages. The state contended that the construction of the dam was upon non-navigable waters and as such federal authorization was not required; instead, state law was to govern under which the state was immune from suit. The court held that it would abide by the Federal Power Commission's determination that

the river was non-navigable, notwithstanding the fact that logs could be floated down it. The federal government thus had no interest in the dam, the matter being entirely within the jurisdiction of the state. Since the matter was not to be governed by federal law, the state could properly assert its immunity defense. (Snow-Florida) W71-01458

UNITED STATES V FIVE ACRES OF LAND (LOW WATER MARK AS BOUNDARY FOR PROPERTY ADJACENT TO NAVIGABLE WATERS).
56 F Supp 628-634 (D Mass 1944).

Descriptors: *Navigable waters, *Boundaries (Property), *Low water mark, *Massachusetts, Condemnation, Eminent domain, Boundary disputes, Legal aspects, Boundaries (Surface), Earth-water interfaces, Judicial decisions, Taxes, Assessments, Federal government, Railroads, United States.

In a proceeding by the United States to take by eminent domain a parcel of land used as a marine railway, the city in which the property was located filed a petition for unpaid taxes. The owners of the property contended that the tax had been illegally assessed so as to preclude the city from receiving any of the condemnation proceeds. The owners, pointing to the fact that a portion of the track and machinery of the railway extended beyond the extreme low water mark, contended that it was illegal for the city to have assessed the entire railway as real property since under Massachusetts law, the outer limit of ownership of land adjacent to navigable water is the extreme low water mark. The owners thus contended that that portion of the railway which extended beyond the low water mark could not be assessed as real property. The court held that it was proper to have assessed the entire marine railway since it was operated as a unit and the bulk of the railway system was attached to the land. (Snow-Florida) W71-01459

THE VICTOR (OBSTRUCTION TO NAVIGATION).
58 F Supp 928-930 (Ed La 1945).

Descriptors: *Louisiana, *Ships, *Rivers and Harbors Act, *Accidents, Admiralty, Bridges, Canals, Banks, Permits, Docks, Damages, Hazards, Judicial decisions, Legal aspects, Navigation, Administrative agencies, Navigable waters.

Libel was brought by the owners of a lugger against a tug for damages resulting from a collision. The facts as found by the District Court for the Eastern District of Louisiana were that libellant lugger was moored temporarily in a channel while picking up men and supplies, that libellee tug was towing two steel barges in the channel where libellant was moored, and that as a result of water and wind currents, the barges in tow swung into the side of libellant, causing it to sink. Libellee argued that it was not liable for the damage to the ship in that libellant was unlawfully moored in the channel in violation of the Rivers and Harbors Act of 1917. The court agreed that libellant's failure to procure a permit to moor in the canal was a violation of that act. The court held that when at the time of collision a ship is in actual violation of a statutory rule intended to prevent collisions, the burden of proof that such mooring was not a cause of the disaster is upon such ship. Libellant failed to meet this burden, and therefore the libel was dismissed. (Barnett-Florida) W71-01460

STURGES V SCHOOL DISTRICT (LIABILITY FOR DIVERTING NATURAL FLOW OF WATER ONTO ANOTHER'S LAND).
33 Pa D and C 525-530 (1938).

Descriptors: *Pennsylvania, *Flow control, *Routing, *Diversion structures, Drainage systems, Ditches, Conveyance structures, Legal aspects, Ju-

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dicial decisions, Public rights, Diversion, Cutoff walls, Relative rights, Alteration of flow. Identifiers: Chester (Penn).

Plaintiff landowner brought suit against defendant school district for damages caused by defendant's diversion of the natural flow of the area's streams and groundwater onto plaintiff's land. Plaintiff contended that defendant, through the actions of its employees, constructed a wall and filled in the natural course of the area's streams and draining groundwater, thus causing all of the water in the area to be forced onto plaintiff's land at one point. Defendant contended that the alleged acts were carried on independently by its employees and that defendant was not liable for the negligent acts of its employees. The court held that defendant's acts constituted the creation of a nuisance for which it was liable. (Quesada-Florida)
W71-01461

SMITH V J S MOZINO AND CO (DISCHARGE OF WATER ONTO ANOTHER'S LAND).

31 Del County 326-329 (Pa Com Pl 1940).

Descriptors: *Pennsylvania, *Discharge (Water), *Land use, *Impounded waters, Damages, Real property, Erosion, Flow, Runoff, Surface runoff, Drainage water, Drainage, Drains, Pipes, Legal aspects, Judicial decisions, Graded, Land forming, Grading, Structures, Soil erosion, Gully erosion, Rainfall.

Plaintiff owned lands adjacent to property of defendant. Defendant graded his land and erected dwellings thereon without negligence. However, as a result of the grading and the construction of downspouts removing water from the roofs of the dwelling houses, water and soil were discharged onto plaintiff's property. Plaintiff contended that defendant had diverted the natural flow of the water and was liable for damages to plaintiff's property. Defendant contended that his actions constituted a non-negligent improvement of his property and imposed no liability on him for consequent damages. The court held that an owner of a lot who improves it without negligence is not liable for damages resulting therefrom unless he has diverted water from its natural course or collected it in volume and caused it to discharge on another's land. Here, defendant had caused water to be collected in volume on the roofs of his houses and discharged on plaintiff's property. He was ordered to stop the discharge of water and pay for elimination of damage caused by previous discharges. (Dye-Florida)
W71-01462

HARRINGTON V FOSTER (OWNERSHIP OF ACCRETION).

264 NW 51-54 (Iowa 1935).

Descriptors: *Olowa, *Accretion (Legal aspects), *Boundary disputes, *Riparian land, Missouri River, Erosion, Bank erosion, Boundaries (Property), Judicial decisions, Legal aspects, Land tenure, Riparian rights, Relative rights, Real property, Land forming.

Plaintiff claimed title to certain lands as accretions to land conveyed to him by his grantor. Defendant contended the land in question was his as the land to which the accretion attached was not riparian land at the time plaintiff's grantor had title thereto quieted in himself. Defendant also claimed the land through the conveyance of a tax deed from his grantor. The court discounted the effectiveness of the tax deed, and held that the property, title to which was quieted in plaintiff's grantor, was itself accreted lands and the decree quieting title gave plaintiff's grantor title to all land to the Missouri River, the southerly border of the land in contest. Consequently, the court held that plaintiff, as the present owner of the riparian land of his predecessor, was the owner of the accreted lands. The trial court's judgment for plaintiff was affirmed. (Price-Florida)

W71-01463

LUNDBERG V UNIV OF NOTRE DAME (REGULATION OF INTERFERENCE WITH NAVIGABLE WATERS).

285 NW 839-841 (Wis 1939).

Descriptors: *Navigable rivers, *Wisconsin, *Obstruction to flow, *Legislation, Navigable waters, Navigation, Transportation, Federal government, Legal aspects, Judicial decisions, Adjudication procedure, Prescriptive rights, Highways. Identifiers: Northwest Ordinance, Obstruction to navigation.

Plaintiffs sought a rehearing on the question of whether the Northwest Ordinance, which governed several territories in 1787, dealt with physical obstructions to navigable waters or carrying places, created any rights in individuals to seek redress for such obstructions or located carrying places or imposed a servitude upon any particular land for such purposes. The factual issues considered in the prior opinion (282 NW 70) were not considered on rehearing. The court reviewed cases seeming to indicate that the ordinance was intended to prohibit only political regulations hampering freedom of commerce, but declined to issue this as its holding. Instead, the court concluded that even if the ordinance prohibited physical interferences with navigable waters or carrying places, it could only relate to established carrying places, not contemplated ones. Plaintiff would have to prove an established portage before obtaining judicial decision of the other question raised. (Morris-Florida)
W71-01464

TRUSTEES OF UNIVERSITY CO-OPERATIVE CO V CITY OF MADISON (DUTY OF CITY TO MAINTAIN CITY SEWER SYSTEM).

288 NW 742-747 (Wis 1939).

Descriptors: *Wisconsin, *Storm drains, *Flood damage, *Drainage effects, Damages, Flooding, Sewers, Rainwater, Rainfall intensity, Tile drains, Seepage, Surface waters, Judicial decisions, Legal aspects, Legislation, Cities, Storm runoff, Floodwater, Drains, Drainage engineering, Drainage practices, Drainage water, Drainage systems.

Plaintiff brought action to recover damages for injury to his property allegedly caused by defendant city's defective and clogged storm drain to which plaintiff's roof drainpipe connected. The court found the evidence to be sufficient to support the verdict that defendant was negligent in damaging the storm drain used by plaintiff and in failing to repair the defect after receiving notice thereof. The court stated that if a duly adopted and executed plan of sewage disposal becomes out of repair to the knowledge of the municipality, the duty devolves upon it to remedy the matter, and it is liable for failure to exercise ordinary care in respect thereto. The judgment for plaintiff was affirmed except as to a part of the damages allowed. As to that part of the damages, a new trial was ordered. (Price-Florida)
W71-01465

IN RE LAKE ELYSIAN HIGH WATER LEVEL (RIGHTS OF RIPARIANS TO HAVE LAKE LEVEL MAINTAINED).

293 NW 140-144 (Minn 1940).

Descriptors: *Minnesota, *Lakes, *Relative rights, *Overflow, Navigable waters, Ditches, Local governments, Legislation, Drainage, Outlets, Floods, Erosion, Judicial decisions, Legal aspects, Water levels, Lake morphology, Lake shores, Dams, Watersheds (Basins), Project purposes.

A ditch was constructed to enlarge the outlet from a lake. The purpose of such construction was to drain slough lands adjacent to the outlet and to control the overflow from the lake. Lands receiving benefit therefrom were assessed accordingly. Sub-

sequently, erosion deepened the ditch, causing a lowering of the lake level. Defendant commissioner contended that the lake level should be restored and issued an order to that effect. Plaintiff landowners opposed the issuance of said order and contended that having paid the above mentioned assessments, they had a right to have the lake level maintained as it had developed over the years since the ditch was constructed. The court ruled that the purpose of the ditch construction was to drain surrounding areas and not to lower the lake level. That being the purpose of the project, it was that for which plaintiffs were assessed. Plaintiffs therefore had no vested right to have the lake maintained at the present lower level. No riparian owner has a right to complain of improvements made to maintain water at its natural level. The commissioner's order approving the restoration project was affirmed. (Price-Florida)
W71-01466

DOHANY V CITY OF BIRMINGHAM (DUTY OF CITY TO PROPERLY MAINTAIN SEWAGE DISPOSAL PLANT).

301 Mich 30, 2 NW2d 907-912 (1942).

Descriptors: *Michigan, *Sewage disposal, *Riparian rights, *Municipal wastes, Relative rights, Cities, Surface waters, Sewage, Watercourses (Legal), Outlets, Pollution, Pollutants, Rainfall intensity, Dams, Structures, Pumps, Pumping plants, Storm water, Sewers, Overflow, Drainage engineering, Legal aspects, Judicial decisions. Identifiers: Birmingham (Mich).

Plaintiff landowner sought to enjoin defendant city from allowing raw sewage to overflow its dam during heavy rains and to flow across his property via a natural watercourse. Defendant relied on cases holding that a riparian owner is allowed reasonable use of a natural watercourse even to the extent of a certain amount of pollution. The court found that no part of the watercourse which ran through plaintiff's land was within the city limits, and therefore defendant was not a riparian owner on such watercourse. Defendant had a duty to care for its sewage disposal during excessive rainfall as well as during normal weather. Plaintiff's right to have the nuisance abated did not depend on the water being used for drinking or domestic purposes. The decree entered allowed a reasonable time for defendant to make repairs and enjoined the future discharge of raw sewage into the watercourse. (Price-Florida)
W71-01467

STEINBRAKER V CROUSE (ABANDONMENT OF PROPERTY IN NAVIGABLE WATERS).

182 A 448-452 (Md 1936).

Descriptors: *Maryland, *Salvage value, *Ships, *Ownership of beds, Admiralty, Contracts, Federal government, Judicial decisions, Legal aspects, Permits, Relative rights, State governments, Watercourses (Legal), Navigable waters, Remedies. Identifiers: *Abandonment, Salvage operations.

Plaintiffs had acquired ownership to 169 ship hulls sunk in navigable waters pursuant to governmental permit. Defendants were residents of the area who were in the process of stripping the hulls of their scrap metal. Before reaching the issue of abandonment, the court stated that the vessels were located on land belonging to the state and that the interest of the federal government extended only to control of the water over the land, not to the soil itself. (Clark-Florida)
W71-01468

ASSELIN V BLOUNT (DEFINITION OF NAVIGABLE RIVERS).

14 A2d 696-701 (R1 1940).

Descriptors: *Rhode Island, *Admiralty, *Navigable rivers, *Commercial shellfish, Contracts,

Watercourses (Legal), Federal government, Judicial decisions, Legal aspects, Ownership of beds, Relative rights, State governments, Remedies, Damages, Navigation, Navigable waters, Navigable rivers, Oysters, Legislation.

While seeding defendant's oyster beds, the boat in which the deceased was riding sank, and he drowned. In deciding that the state workmen's compensation act, rather than admiralty law, was applicable in this case, the court had occasion to define navigable rivers as those which are susceptible of use in their ordinary condition as highways of commerce, over which trade and travel are or may be conducted in the customary modes of trade and travel on water. (Clarke-Florida)
W71-01469

LOWER TP V CITY OF WILDWOOD (MIDDLE OF STREAM AS COMMON BOUNDARY).
31 A2d 807-809 (NJ Ct Err and App 1943).

Descriptors: *New Jersey, *Cities, *Boundaries (Property), *Streams, Judicial decisions, Legal aspects, Boundary disputes, Relative rights, Local governments, Real property, Navigable waters, Legislation.
Identifiers: Wildwood (New Jersey).

Plaintiff township brought action pursuant to statute against defendant city to appoint a commission to monument a mutual corporate boundary. Plaintiff contended that the boundary, a stream, had altered its course so as to change the original boundary. The court noted that the legislature had usually fixed the middle of the stream as the common boundary under these circumstances, and stated that at common law conveyances of land bounded by streams above tide water extended to the middle of the stream. In denying plaintiff's request for a commission, the court found that the statute permitted appointment of a commission only when the monumented boundary was capable of remaining inviolate, without further change. Since the stream could alter its course in the future, the statute was held inapplicable. (Hart-Florida)
W71-01470

SGARLATA V CITY OF SCHENECTADY (CITY'S LIABILITY FOR FLOOD DAMAGE CAUSED BY STREAM BEING BACKED UP BY OBSTRUCTED CULVERT).

250 App Div 789, 294 NYS 768-772 (1937).

Descriptors: *New York, *Flood damage, *Obstruction to flow, *Cities, Surface drainage, Water injury, Natural flow doctrine, Streams, Streamflow, Flooding, Culverts, Drainage, Runoff, Rainwater, Surface runoff, Drains, Drainage systems, Judicial decisions, Adjudication procedure, Water law, Legal aspects, Local governments, Subsidence, Settlement (Structural).
Identifiers: Schenectady (N.Y.).

Plaintiff property owner brought action against defendant city to recover for damages caused by the overflow of a creek during heavy rainfall. Plaintiff contended that the flooding was caused by defendant's failure to clean silt, sediment, and debris from a culvert through which the creek flowed, thereby causing the creek to back up and overflow onto plaintiff's land. The flooding caused subsidence of plaintiff's buildings. Defendant argued that the culvert was cleaned out, and in any event, that a city is not liable for governmental functions such as drainage system maintenance. Affirming per curiam a judgment for plaintiff, the court held that the evidence was sufficient to sustain the referee's findings. Two justices dissented on the ground that none of the evidence was sufficient to establish a basis for defendant's liability. (Liptak-Florida)
W71-01471

KEARNS V TOWN OF BLOOMFIELD (PRESCRIPTIVE RIGHT TO USE DRAINAGE DITCH OVER PRIVATE PROPERTY).

138 A 386-387 (NJ 1927).

Descriptors: *New Jersey, *Surface drainage, *Easements, *Prescriptive rights, Natural flow doctrine, Cities, Local governments, Judicial decisions, Legal aspects, Drainage, Drainage practices, Drains, Ditches, Natural flow, Overflow, Surface waters, Flooding, Flood prevention, Alteration of flow, Obstruction to flow, Public benefits, Outlets, Drainage water, Land use.
Identifiers: Bloomfield (New Jersey).

Plaintiff landowner had filled in a ditch on his property which caused the water which ordinarily flowed therethrough to back up onto adjacent properties. Plaintiff sought to enjoin defendant town from trespassing on his property to remove such fill. Defendant contended it had a right to use the ditch for drainage, as it was the natural course of drainage for the area, and that it had acquired by prescription such drainage rights. The court ruled that defendant had the right to enter upon and make use of private property for the public good, that the draining of adjacent lands across plaintiff's lands through a well-defined channel for more than twenty years constituted an easement, that the ditch was the natural outlet for said waters and that defendant had a right to keep the watercourse open to prevent flooding and the creation of a public nuisance. Therefore, plaintiff was enjoined from interfering with defendant's clearing of the ditch. (Price-Florida)
W71-01492

ARKANSAS POWER AND LIGHT CO V HILLARD (CONDEMNATION OF LANDS TO BE FLOODED UNDER BACKWATERS OF A DAM).

47 SW2d 575-576 (Ark 1932).

Descriptors: *Arkansas, *Flooding, *Dams, *Backwater, Condemnation, Easements, Right-of-way, Floodwater, Design flood, Flood routing, Reservoirs, Legal aspects, Judicial decisions, Reservoir design, Roads, Culverts, Roadbanks, Road construction, Relative rights, Land tenure, Compensation.

Plaintiff brought an action to recover damages for the cost of constructing a fill and culvert across a flooded roadway. Plaintiff, having sold a portion of her property to defendant power company under condemnation proceedings arising from contemplated flooding of such property by the construction of a dam, contended that she had reserved the use of the roadway which passed over the condemned property. Plaintiff contended that the subsequent flooding of the road by the back waters of the dam violated such reservation and that she was thus entitled to the cost of building a fill and culvert to restore her use of the roadway. Defendant contended that there had been no agreement as to any reservation of the roadway and that the flooding of the roadway had been anticipated and revealed at the time of the sale of the property. The court held that there was no evidence of any reservation either in the deed or under a parol agreement. Finding no agreement that the road was not to be flooded, the court reversed the trial court's judgment for plaintiff. (Snow-Florida)
W71-01502

WATSON V CHESAPEAKE AND OHIO RY (RAILROAD'S LIABILITY FOR CHANGING SURFACE DRAINAGE BY ELEVATING TRACKS).

238 Ky 31, 36 SW2d 641-644 (1931).

Descriptors: *Kentucky, *Surface drainage, *Railroads, *Elevation, Legal aspects, Judicial decisions, Damages, Local governments, Legislation, Natural flow, Repulsion (Legal aspects), Drainage, Surface waters, Transportation, Right-of-way, Civil

engineering, Public lands, Public rights, Cities, Highways, Diversion, Alteration of flow, Riddance (Legal aspects), Access routes.

Plaintiff property owner sued defendant railroad company for damages suffered after defendant raised the level of its tracks and added additional tracks in an alley adjoining plaintiff's property. Plaintiff claimed the change in elevation caused flooding of its property and damaged its right of ingress to and egress from the alley. Defendant asserted that it held an exclusive right to use of the alley. The Court of Appeals of Kentucky, in reversing the lower court's dismissal of the petition, held the city could not grant exclusive right to an alley dedicated to public use. Plaintiff had an easement for access to the alley. The court also found the natural drainage was from plaintiff's property into the alley, and thus the railroad was liable for any flood damage caused by elevation of its tracks which affected the natural drainage. The court stated that the measure of damages was the difference in market value of plaintiff's property before and after defendant's elevation of the tracks. (Morris-Florida)
W71-01518

ST LOUIS SAN FRANCISCO RY V MANNING (RAILROAD'S LIABILITY FOR DESTROYING NATURAL PROTECTION FROM RIVER OVERFLOW).

26 SW2d 579-581 (Ark 1930).

Descriptors: *Arkansas, *Embankments, *Overflow, *Diversion, Legal aspects, Judicial decisions, Damages, Railroads, Right-of-way, Ravines, Channels, Rivers, River flow, Flood damage, Floods, Surface runoff, Surface drainage, Farms, Natural flow, Currents (Water), Overland flow, Water injury.

Plaintiff farm owner sued defendant railroad company for damages which resulted from the flooding of her land allegedly caused by defendant's negligent cutting of a ditch through a natural ravine embankment protecting her land. The ravine ordinarily carried overflow waters of the Spring River back into the river. Defendant claimed that it did not obstruct or divert waters from any natural channel onto plaintiff's land and that the water for the period in question was so high it would have overflowed plaintiff's lands even if there had been no ditch. The Supreme Court of Arkansas, in affirming a judgment for plaintiff, held there was no difference in diverting stream waters onto land and cutting a natural barrier so as to release a swift current onto the land. The court noted further that the jury found it was the current from the overflow that caused the damage, rather than merely the overflow, and that, because of the ditch, a lower overflow was able to reach the land. (Morris-Florida)
W71-01519

JOHNSON V RATLIFF (LIABILITY FOR DIVERSION OF SURFACE DRAINAGE).

233 Ky 187, 25 SW2d 355-357 (1930).

Descriptors: *Kentucky, *Surface drainage, *Rainfall intensity, *Riddance (Legal aspects), Boundaries (Property), Drainage effects, Drainage, Surface waters, Surface runoff, Rain, Rainfall-runoff relationships, Flood damage, Legal aspects, Judicial decisions, Retaining walls, Damages, Diversion.

Plaintiff homeowner sued defendant, who owned an adjoining lot, for damages allegedly caused by defendant's diversion of surface water through construction of a retaining wall. Plaintiff claimed that the diverted waters, after extensive rains, entered her basement. Defendant denied that the construction injured plaintiff and argued that he could not be liable for extraordinary rainfall. The Court of Appeals of Kentucky, in reversing a lower court decision for defendant, held extensive rainfall was not the same as extraordinary rainfall. The court ordered a new trial because of a jury instruction

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which indicated plaintiff could not recover if he could have mitigated damages through exercise of ordinary care. A proper instruction would have told the jury to exclude that portion of the damages which plaintiff could have avoided through exercise of ordinary care and at reasonable cost. (Morris-Florida)
W71-01520

BARRILLEAUX V DELAUNE (LIABILITY FOR LEVEE OBSTRUCTING DRAINAGE SERVITUDE).
176 La 377, 145 So 776-779 (1933).

Descriptors: *Louisiana, *Surface drainage, *Easements, *Levees, Dikes, Flood protection, Seepage, Canals, Drainage, Drainage systems, Pumping, Cities, Contracts, Natural flow doctrine, Obstruction to flow, Alteration of flow, Relative rights, Judicial decisions, Legal aspects, Use rates, Overlying proprietor.

Plaintiff plantation owner sought to enjoin defendant plantation owner from maintaining a levee which prevented drainage from plaintiff's land. Plaintiff claimed a drainage servitude across defendant's land. Defendant's property was low, and excess water from the surrounding areas drained into it. Defendant's predecessor had reclaimed this tract by digging canals and erecting levees around the entire perimeter of his property. Defendant's predecessor agreed to accept drainage from the surrounding areas for a fee. This contract continued in force for several years until plaintiff declined to renew the agreement. Plaintiff then pumped his excess water into a canal until the municipality dammed the canal. Plaintiff then brought this action. Defendant asserted that plaintiff had abandoned the original servitude. Sustaining this assertion, the court refused the injunction and affirmed the judgment of the lower court for defendant. (Hart-Florida)
W71-01536

WATER LAW'S DOUBLE ENVIRONMENT: HOW WATER LAW DOCTRINES IMPEDE THE ATTAINMENT OF ENVIRONMENTAL ENHANCEMENT GOALS,
John C. Ohrenschall, and Edgar A. Imhoff.
5 Land and Water L Rev 259-292 (1970). 33 p, 144 ref.

Descriptors: *Environmental effects, *Water utilization, *Riparian rights, *Prior appropriation, Preferences (Water rights), Beneficial use, Social aspects, Conservation, Environment, Pollution abatement, Institutional constraints, Water supply, Water pollution, Legal aspects, Judicial decisions, Non-consumptive use, Reasonable use, Legislation, Public rights, Water law, Competing uses, Federal-state water rights conflicts.

The present water law doctrines of riparian rights and prior appropriation impede rather than further the attainment of environmental enhancement goals. Increasing population and accelerated deterioration of the environment make a reshaping of these doctrines necessary. The traditional interpretations of the two doctrines arose in an era of environmental exploitation which must give way to environmental enhancement. The 'beneficial use' standard must be re-interpreted in order to facilitate uses compatible with a quality environment. The necessity for actual diversion to establish a recognized use should be eliminated. Non-consumptive uses should generally be given higher priorities in case of conflicting uses than industrial or most other consumptive uses. The 'reasonable use' standard in water law ensures flexibility but instills insecurity in water rights. Greater public control in the form of state or interstate commissions are needed to fully develop a water law system oriented toward environmental enhancement. (Caldwell-Florida)
W71-01547

THE PUBLIC TRUST IN TIDAL AREAS: A SOMETIME SUBMERGED TRADITIONAL DOCTRINE.

79 Yale L J 762-789 (1970). 26 p, 128 ref.

Descriptors: *Public rights, *Competing uses, *Economics, *Intertidal areas, Cost-benefit analysis, Tidal waters, Legal aspects, Judicial decisions, Easements, Land tenure, Public lands, Demand, State jurisdiction, Shores, Relative rights, Prescriptive rights, Priorities, Navigation, Access routes, Recreation, Remedies, History.

Due to the increasing demands upon tidal areas, the number of conflicting interests in these areas also increases. It is necessary to insure the widest possible and most effective utilization of tidal areas. In Roman law, all of the shore and tidal areas were under common ownership. In medieval times, however, the shores often came to be considered the personal property of feudal princes. Beginning with the Magna Charta, there has been a gradual trend toward increased public rights in tidal areas. These rights have often been expressed in terms of easements or of prescriptive public rights. Vastly increased demands upon the resources of tidal areas are running far ahead of the protections afforded public interests. Modern 'public trust' theory utilizes both easements and prescriptive rights. It also recognizes several categories of public interests which should be protected in and of themselves, including navigation, ports and recreation. These often competing uses have been afforded different priorities at different times, with navigation generally given the most absolute protection. (Caldwell-Florida)
W71-01548

WATER LAW IN SOUTHEASTERN WISCONSIN.

Wisconsin Univ., Madison.

Southeastern Wisconsin Regional Planning Commission, Technical Report Number 2, (1966). 92 p, 169 ref.

Descriptors: *Wisconsin, *Governments, *Watershed management, *Water law, Water pollution, Water pollution control, Legal aspects, State governments, Local governments, Administration, Management, Flood routing, Water resources development, Water management (Applied), Planning, Watersheds (Basins), Regions, Surface waters, Rivers, Flood control, Groundwater, Area development, Institutions, Legislation, Water policy.

The study is divided into segments: (1) riparian and public rights law; (2) groundwater law; and (3) diffused surface water law. Each segment is first dealt with generally, followed by surveys of more complex problems involving one or more segments of the field. Riparian and non-riparian use of water are discussed, along with the concept of navigability. Groundwater law and diffused surface water law are treated in a more cursory fashion. Flood plain regulations in general and those of Wisconsin in particular are examined. Pollution and pollution control are discussed from the public and private standpoints. Watershed management is studied, with particular emphasis on the Root River watershed and the organization of local governments to manage whole watersheds. Maps of the southeastern Wisconsin region and the Root River watershed are included, as are copies of Wisconsin statutes affecting water law and a model floodway encroachment act. (See also W71-01550 and W71-01551). (Dye-Florida)
W71-01549

WATER LAW IN SOUTHEASTERN WISCONSIN (RIPARIAN AND DIFFUSED SURFACE WATER LAW).

Wisconsin Univ., Madison.

Southeastern Wisconsin Regional Planning Commission, Technical Report Number 2, p 1-40 (1966).

Descriptors: *Water law, *Wisconsin, *Governments, *Watershed management, Local governments, Administration, Management, Flood routing, Water resources development, Water management (Applied), Planning, Watersheds (Basins), Surface waters, Flood control, Groundwater, Area development, Legislation, Water policy, Flood plain zoning, Floods, Natural flow doctrine, Reasonable use, Navigable waters, Legal aspects, State governments.

The three principal divisions of water law: riparian and public rights law, groundwater law and diffused surface water law, are discussed with regard to the historical and substantive reasons for such categorization. Riparian and public rights to the use of water including riparian doctrine, the natural flow doctrine, the reasonable use doctrine and the concept of navigability are explored. Augmentation of common law riparian doctrine by legislation is examined briefly. The law governing use of sub-surface and diffused surface water is given brief treatment. Diffused surface water law is treated from the private and public standpoints as to discharge and drainage. Common law and statutory regulation of flood plains are discussed, with emphasis on suggested patterns of regulation. (See also W71-01549). (Dye-Florida)
W71-01550

WATER LAW IN SOUTHEASTERN WISCONSIN (WATERSHED MANAGEMENT AND POLLUTION CONTROL).

Wisconsin Univ., Madison.

Southeastern Wisconsin Regional Planning Commission, Technical Report Number 2, (1966), p 41-92.

Descriptors: *Wisconsin, *Floods, *Water resources development, *Water pollution control, Water pollution, Flood protection, Flood plain zoning, Governments, Watershed management, Water law, Legal aspects, Legislation, State governments, Federal government, Administration, Management, Surface waters, Flood control, Area development, Institutions, Water policy, Diversion, Drainage districts, Public rights, Relative rights.

Constitutional and statutory authority for regulation of flood plain zoning and construction by the Wisconsin Industrial Commission are treated briefly. Federal, state, local and private interests and authority in pollution control are discussed in the context of the administrative machinery available in Wisconsin for pollution control. The role of drainage districts in flood control and the remedies available to districts against private owners backing floodwaters into drainage districts are discussed. The Root River watershed is examined, as are the legal aspects of interbasin water diversion. The implications of watershed development and local construction of water development facilities are examined. Conclusions and recommendations are followed by maps of southeastern Wisconsin and the Root River watershed and appendices of water law related statutes. (Dye-Florida)
W71-01551

AN ACT RELATING TO ENFORCEMENT BY SEA AND SHORE FISHERIES AND THE MAINE MINING BUREAU.
Maine Pub Laws ch. 535 (1970) (amending Rev Stat 10.2155, 12.3752.6).

Descriptors: *Maine, *Fisheries, *Administration, *Adjudication procedure, Permits, Legal aspects, Commercial fishing, Administrative agencies, Mining, Regulation, Administrative decisions, Supervisory control (Power), Water pollution control, Oil.

The Commissioner of Sea and Shore Fisheries is given broad licensing power in connection with commercial fishing in the state. Such licenses may be suspended by the Commissioner for violations of statutes or regulations, or for other causes. Procedures are established whereby a person

whose license has been suspended may petition for reinstatement. A hearing must be held on the request, after which the license may be reinstated if the Commissioner is satisfied that such action would be in the interest of justice. The Mining Bureau is given broad powers to prevent waste of oil and gas and resultant pollution, and to make regulations, issue permits and collect fees in exercise of these powers. (Caldwell-Florida)
W71-01552

POLLUTION ABATEMENT FACILITIES--GRANTS AND LOANS FOR PRELIMINARY PLANNING.

Maine Pub Laws, ch 546 (1970) (amending Rev Stat 38.412).

Descriptors: *Maine, *Pollution abatement, *Grants, *Treatment facilities, Local governments, Government finance, Planning, Construction, Legal aspects, Project planning, Costs, Cities, Administrative agencies, Financing, Sewers, Legislation, Estimated costs, Surveys, Civil engineering, Population, Non-structural alternatives.

The Water Improvement Commission of Maine is given specific guidelines in this amending statute for making pollution-abatement grants to local governments and planning agencies. The superseded section provided that the Commission was authorized to pay up to 50 per cent or \$2500, whichever was less, of sewage surveys. The instant section expands the grant-making power to include aid to all types of planning for pollution treatment facilities and sets up population brackets whereby more populous areas get more money. Grants are authorized for analyses of existing problems, area studies, cost estimates, and preliminary sketches of facilities. No grants can be made for areas having been the subject of a prior study within 5 years, nor for any costs incurred after the town or planning agency has voted to undertake the project. Non-interest bearing loans are also authorized. The funds for such grants and loans are to come from proceeds from bond issues. (Caldwell-Florida)
W71-01553

AN ACT RELATING TO PERMITS FOR DREDGING AND ERECTION OF CAUSEWAYS, DOCKS, ETC. IN TRIBUTARIES OF GREAT PONDS.

Maine Pub Laws ch 551 (1970) (amending Rev Stat 12.514).

Descriptors: *Maine, *Great ponds, *Permits, *Dredging, Tributaries, Streams, Administrative agencies, Bodies of water, Legal aspects, Regulation, Ponds, Riparian land, Riparian rights, Surface waters, Landfills, Marinas, Legislation.

This act amends the statute dealing with the protection of great ponds. Permits must be obtained for any dredging in tributary rivers or streams of great ponds, as well as in the great ponds themselves. The notice-giving procedures in the issuance of permits are amended. Tributary rivers or streams of great ponds are added as a category of waterbodies covered by the statute. Great ponds are redefined to include not only inland fresh water bodies having a natural surface area greater than 10 acres, but also any waterbody which is artificial or increased from natural size, is larger than 30 acres and whose shore is owned by two or more persons. (Caldwell-Florida)
W71-01554

WATERS-POLLUTION-DISCHARGE LICENSE.

Maine Pub Laws ch. 567 (1970) (amending Rev Stat 38.414).

Descriptors: *Maine, *Waste disposal, *Regulation, *Permits, Administrative agencies, Water pollution control, Standards, State governments, Control, Legislation, Legal aspects, Administrative decisions, Supervisory control (Power), Wastes.

The Water Improvement Commission has the power to issue waste discharge licenses. These licenses may be issued after a hearing by not less than three members of the Commission, and any issuance thereupon is deemed to be action by the full Commission. Evidence to be considered by the Commission at such a hearing shall include, but not be limited to, the applicant's financial ability to meet state water pollution control standards. (Caldwell-Florida)
W71-01555

OIL DISCHARGE PREVENTION AND POLLUTION CONTROL.

Maine Pub Laws ch. 572 (1970) (amending Rev Stat 38.416, adding 38.3.541 - .557).

Descriptors: *Maine, *Oil, *Water pollution control, *Coasts, Water utilization, Land use, Recreation, Commercial fishing, Legislation, Regulation, Transportation, Public rights, Legal aspects, State jurisdiction, Administrative agencies, Facilities, Oil industry, Permits, Adjudication procedure, Disasters, Treatment, Government finance, Damages, Tidal waters.
Identifiers: *Oil spills.

The Maine Environmental Improvement Commission is given broad powers in regulating oil transportation and dealing with violations of its regulations. The Commission licenses oil terminal facilities, and regulates vessel operative and inspection requirements, discharge reporting procedures, and pollution removal procedures, among other areas. The Governor is given broad emergency powers in case of disasters involving major oil spills. Violations of the act or Commission regulations is made punishable by a fine of up to \$5000 per day. The Maine Coastal Protection Fund is set up for the purposes of research and development, reimbursing third parties damaged by oil pollution and funding Commission activities, including oil removal costs. Polluters must either remove pollution themselves or reimburse the fund for Commission costs. Coastal areas, being covered by the above act, are removed from the scope of Section 38.416, which deals with discharges into inland waters. (Caldwell-Florida)
W71-01556

THE TUNABOAT DISPUTE AND THE INTERNATIONAL LAW OF FISHERIES.

6 Calif Western L Rev 114-133 (1969). 19 p, 85 ref.

Descriptors: *International law, *Commercial fishing, *International waters, *Fisheries, Oceans, Boats, Foreign countries, Continental margin, Relative rights, Law of the sea, Resource allocation, Economics, International commissions, Legislation, Foreign waters, Treaties, Legal aspects, Political aspects, Conservation, Adjudication procedure, Fishing, Jurisdiction, Federal government, United Nations.

Seizures of U.S. tunaboats by several South American countries raise important issues for international law. The United States claims exclusive jurisdiction over ocean waters to a distance of three miles, reserving certain fishing priorities for a further distance. Some nations, however, claim exclusive fishing rights out to a distance of 200 miles, which rights are not recognized by the United States. International conventions have failed to resolve the dispute, and this has aggravated political tensions. The author contends that the roots of the conflict go beyond the superficial legal principles of 'freedom of the seas' and 'inherent rights'. Different needs in protecting commercial development of each country and the difficulty in reaching agreement as to allocation of the fish resources of the sea are bases for the dispute. The author suggests that ownership, or at least management, of the living resources of the sea be vested in an international agency, most likely the United Nations. This would provide needed control over resource

allocation and provide the United Nations with needed funds through fees for use of these resources. (Caldwell-Florida)
W71-01557

AN ACT RELATING TO WATER QUALITY STANDARDS.

Maine Pub Laws ch 581 (1970) (amending Rev Stat 38.364, adding 12.2108).

Descriptors: *Maine, *Spawning, *Water quality control, *Classification, Tidal waters, Fish management, Administrative agencies, Adjudication procedure, Fish reproduction, Fish conservation, Bacteria, Coliforms, Standards, Water quality, Water utilization, Recreation.

The Commissioner of Inland Fisheries and Game is given the power to designate certain waters as fish spawning grounds. The Commissioner may take such action on his own initiative or upon request of any state agency. Provisions are made for notice, a public hearing and a record to be made of such hearing. If, after weighing the evidence presented at the hearing, the Commissioner determines that the area concerned should be protected, he may issue an order designating the area as a fish spawning ground. Specific water quality standards are set forth. (Caldwell-Florida)
W71-01558

REPORT ON MAINE LAW AFFECTING MARINE RESOURCES.

Report on Maine Law Affecting Marine Resources, vol 2, p 157-417, 1970. Append.

Descriptors: *Maine, *Marine geology, *Sea water, *Coasts, Coastal engineering, Legal aspects, Judicial decisions, Boundaries (Property), Continental shelf, Law of the Sea, Bays, Erosion, Accretion (Legal aspects), Banks, Fishing, Riparian rights, Tidal waters, Legislation, Land reclamation, Eminent domain, Natural resources, Conservation, Cities, Parks, Public utilities.

This report places emphasis on Maine law and its responsiveness to the problems caused by the exploitation of marine resources. To allow a better perspective of these problems, basic principles of land law affecting marine resources are catalogued. One such problem is the placement of marine boundaries. Sub-problems dealing with marine boundaries include but are not limited to: the extent of Maine's territorial waters; the jurisdictional boundaries of state agencies in Maine's waters; and the demarcation of private versus public ownership on the land-sea interface. The report examines boundary problems relating to riparian lands, with a thorough analysis given to public and private rights in the seashore and tidal waters. Constitutional and statutory restrictions are examined as to their effect on the acquisition, disposal and regulation of public lands. The report also raises questions regarding the application of existing law to the problems of marine resources. Two questions are: (1) to what extent under current law may Maine's marine resources be privately owned and managed; and (2) exactly what is the state's power over submerged lands and territorial waters. Extensive efforts are made to answer these and similar questions. (Barnett-Florida)
W71-01559

LINCOLN COAL CO V DEATON (LIABILITY FOR EROSION CAUSED BY CHANGED RIVER CURRENT).

229 Ky 330, 17 SW2d 249-251 (1929).

Descriptors: *Kentucky, *Currents (Water), *Bank erosion, *Bridge construction, Riverflow, Legal aspects, Judicial decisions, Damages, Farms, Land, Rivers, Riparian land, Natural flow, Bridges, Piers, River beds, Flow, Diversion, Erosion, Accelerated erosion, Banks, Channel erosion.

Plaintiff farm owner sued defendant coal company for damage caused when part of plaintiff's land was washed away. The erosion was caused by a river current allegedly altered by defendant's construction of a bridge. Plaintiff claimed that the bridge pier in the middle of the river had caused the water to swirl against her land and that more than one acre had been washed away. Defendant contended the evidence did not support such a finding, that excessive rainfalls caused the damage and that no negligence was shown. The Court of Appeals of Kentucky, in affirming a lower court verdict for plaintiff, held that the jury chose between conflicting evidence, and there was no reason for the court to overturn the findings of fact. Moreover, once the jury found that defendant had diverted the flow of the river, it was not necessary to show negligence. (Morris-Florida) W71-01560

THE 'RACE' FOR THE SEABED: THE RIGHT TO EMPLACE MILITARY INSTALLATIONS ON THE DEEP OCEAN FLOOR,
William A. Stoever.
4 Int Law 560-568 (1970). 8 p, 33 ref.

Descriptors: *International law, *Military aspects, *Oceans, *Beds, Exploitation, Continental shelf, Legal aspects, International waters, Relative rights, Political aspects, Jurisdiction, United Nations, Law of the sea, Foreign countries, Treaties, Organizations, Ownership of beds, Technology, International commissions, Electronic equipment.

The possibility of the emplacement of military installations on the ocean floor dictates that new doctrines of international law be developed in this area. The author argues that the status of the deep ocean floor is as yet undefined. Future definition will be worked out as a synthesis of competing pressures between expansion of undersea military activity, made possible by technology, and the increasing pressure for international agreement. A nation has exclusive rights in the continental shelf surrounding its coasts. How far national jurisdiction can be extended beyond the limits of exploitability of the shelf is a subject of much disagreement. The author argues that it is unlikely that the United States would unilaterally declare its intent to appropriate areas of the deep ocean floor. The United Nations has debated this question and appointed a commission to study the problem. Generally, less developed nations tend to be more favorably inclined toward an immediate international agreement limiting military exploitation of ocean beds than are nations whose technology would permit such exploitation. The author foresees a compromise which would ban offensive weapons but permit defensive electronic apparatus. (Caldwell-Florida) W71-01561

LET THE POLLUTER BEWARE (LEGAL RAMIFICATIONS OF POLLUTION),
R. J. Farrell.
75 Case and Com 3-8 (1970).

Descriptors: *Air pollution, *Water pollution, *Legislation, *Legal aspects, Water pollution sources, Water pollution effects, Federal government, State governments, Water quality control, Damages, Remedies, Governments, Pollution abatement, Abatement, Water conservation, Oily water, Oil wastes, Oil industry, Oil, Oil wells, Regulation.

This article deals chiefly with problems of air pollution, with some attention to water pollution. Legal developments affecting both types of pollution are presented. Specific developments relating to water pollution such as the amendments to the Water Quality Act of 1965 which have been proposed to deal with offshore drilling, vessels, pollution disasters and removal of polluting substances and the Department of Interior's suggestions of absolute liability as a basis of recovery against oil companies whose drilling apparatus pollute water are ex-

amined. Legislative trends including: (1) extension of federal jurisdiction in the pollution area; (2) increased penalties; and (3) advancement of abatement timetables are discussed. That the federal government may enter the field with tax incentives to control pollution out, as are developing changes in tort concepts to facilitate recovery for pollution damage outside the existing concept of nuisance. (Dye-Florida) W71-01562

HEWITT V PERRY (REASONABLE USE OF RECREATIONAL EASEMENT).
39 NE2d 575-576 (1942).

Descriptors: *Massachusetts, *Easements, *Usufructuary right, *Reasonable use, Navigable waters, Beaches, Recreation, Swimming, Fishing, Boating, Legal aspects, Judicial decisions, Relative rights.

Plaintiff sought an injunction to compel removal of defendant's bulkhead and to restrain defendant from building a new bulkhead. Defendant counter-claimed seeking to restrain plaintiff from using the beach area in dispute as a mooring ground or in any way for maintenance of her commercial business of letting boats. Plaintiff had been granted an easement to use the beach for bathing, boating, fishing and other recreation but had been using it for commercial business. In the lower court plaintiff was enjoined from such use. The Supreme Judicial Court of Massachusetts affirmed. Plaintiff's easement was general and unrestricted in nature, but plaintiff's commercial use was not a reasonable use and as such surcharged the easement granted. (Duss-Florida) W71-01563

WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (LICENSING OF POWER COMPANIES).
289 NY 353, 45 NE2d 907-908 (1942).

Descriptors: *New York, *Administrative agencies, *Water utilization, *Navigable waters, Permits, Legal aspects, Judicial decisions, Rivers, Diversion, Hydroelectric power, State governments, Legislation, Regulation, Adjudication procedure, Water supply.

Plaintiff New York Water Power and Control Commission sought a declaratory judgment and an injunction to prevent defendant power company from using water from the Niagara River because of defendant's refusal to apply for a license and pay rental for use of the water. The trial court dismissed the complaint for injunctive relief upon the merits, but enumerated certain rights of the parties. The appellate division reversed the declaratory judgment and modified it to read that the complaint was dismissed on the merits. Both parties appealed. The Court of Appeals of New York affirmed on the sole ground that defendant was exempted from state licensing requirements by state statute. Because the statute excluded defendant, and because the state itself was not a party to the litigation, there was no grounds for granting a declaratory judgment. (Duss-Florida) W71-01564

AIR AND WATER POLLUTION,
Gerald Leinwand.

Air and Water Pollution (1969). 160 p, 1 illus, 40 photo, 2 dwg, 1 chart, 19 ref.

Descriptors: *Water pollution, *Water pollution sources, *Water pollution effects, *Air pollution, Dispersion, Environmental sanitation, Pollution abatement, Pollutant identification, Pollutants, Public health, Cities, Municipal wastes, Industrial wastes, Wastes, Water pollution treatment, Water quality, Water resources, Air pollution effects, Effluents, Environmental engineering, Fallout, Radioactive wastes, Waste disposal, Waste treatment.

Part one is a general presentation by the editors of the problems and challenges of air and water pollution. The history of pollution and several historical examples of it are sketched, followed by superficial assessments of the costs of pollution and the potential costs of alleviating it. The causes of pollution are discussed, along with suggestions as to what individuals, industry, cities, states and the federal government can do to attack the sources or decrease the effects of pollution. Following this introduction are fifteen short articles by assorted authors, five of which deal with water pollution. The articles explore pollution by municipal and industrial wastes, pesticides and other chemicals, detergents, and radioactivity. Forty-three photographs, illustrations and charts complement the textual material and a bibliography of suggested readings in the pollution area is included. (Dye-Florida) W71-01565

THE WATER CRISIS,
Frank E. Moss.

The Water Crisis (1968). 319 p, 17 map, 2 illus, 1 dwg, 1 chart.

Descriptors: *Water resources development, *Water pollution, *Impaired water quality, *Water supply, Water quality control, Water utilization, Water pollution sources, Water pollution effects, Water pollution treatment, Pollution abatement, Legal aspects, Legislation, Administrative agencies, Planning, Multiple-purposes projects, Water policy, Federal government, Water management (Applied), Public rights, River basin development, Interstate commissions, Weather modification, Desalination, Social aspects.

Water resources in the United States are in a state of worsening crisis. The quantity of available water is fixed and may soon become inadequate to serve the needs of the exploding population. Pollution has resulted in serious deterioration of water quality in all areas of the country. From this premise, the author discusses problems of obtaining maximum use of groundwater resources, destruction of land resources by mining and other industries, flood prevention and preservation of recreation areas. Several examples of attempts to deal with the water crisis are cited. The author points to efforts of soil and forest conservation, desalination projects, treatment and re-use of polluted water, research projects, and efforts to divert water resources from well-watered to dry regions. The author concludes that the crisis can only be alleviated by cooperation between all levels of government. A comprehensive national water policy, administered by a National Water Commission, is necessary to coordinate efforts to solve water problems and to direct a national program toward these ends. (Caldwell-Florida) W71-01566

MAIER V PUBLICKER COMMERCIAL ALCOHOL CO (LIABILITY FOR POLLUTION AS PRIVATE NUISANCE).
62 F Supp 161-168 (ED Pa 1945).

Descriptors: *Pennsylvania, *Rivers and Harbors Act, *Admiralty, *Delaware River, Solid wastes, Legal aspects, Judicial decisions, Remedies, Damages, Wastes, Salvage value, Ships, Navigable rivers, Navigation, Regulations, Water pollution. Identifiers: *Private nuisance.

Libelant salvage company sued respondent manufacturer for damages to meet the increased cost of raising a partially sunken vessel in the Delaware River. Libelant alleged that respondent discharged grain residue into the river in violation of the Rivers and Harbors Appropriation Act of 1899 and that the grain filled the holds of the vessel, thus making the vessel more difficult to raise. The court held that violation of criminal statute did not by itself constitute negligence and that a lack of due care had not been proven. However, the court ruled that libelant could recover on the basis of a private nuisance since the results were foreseeable and

preventable, and thus intentional. The court held further that the fact that libelant also may have been in violation of the Rivers and Harbors Act for obstructing navigable waters would not be a defense available to respondent. Libelant's violation may have been a condition precedent to the injury, but it was not the cause. (Morris-Florida) W71-01567

BOWERS V PRICE (LIABILITY FOR INCREASE OF NATURAL FLOW BY DOMINANT ESTATE).

56 Pa D and C 256-263 (1944).

Descriptors: *Pennsylvania, *Surface runoff, *Natural flow, *Reasonable use, Boundaries (Property), Legal aspects, Judicial decisions, Surface drainage, Storm runoff, Topography, Paving, Roofs, Damages, Rain water, Drains, Riddance (Legal aspects), Relative rights, Overlying proprietor.

Plaintiffs sought an injunction against defendant to prevent him from causing rain water to drain into plaintiffs' cellar. Plaintiffs also sought damages for injury allegedly caused by defendant's construction of a sidewalk bordering his property and a gabled roof over a garage. Plaintiffs alleged the construction caused water to drain onto his property in greater quantities than it had previously. Defendant denied liability, claiming any improvements to his property were wholly within his rights. The court held that defendant was the dominant tenement and as such had an easement over the lower servient tenement of plaintiffs as long as he did not construct an artificial channel to concentrate the drainage. The court said Pennsylvania follows the rule that every person may make reasonable use of his own land and any damage such use causes is damage without injury. (Morris-Florida) W71-01568

DOLL V BLITZ (RIGHT TO REASONABLE DOMESTIC USE OF SPRINGWATER).

1 Monroe L R 184-191 (Pa Eq 1939).

Descriptors: *Pennsylvania, *Water demand, *Pipelines, *Spring waters, Mineral water, Subsurface waters, Beneficial use, Consumptive use, Water allocation (Policy), Judicial decisions, Legal aspects, Domestic water, Water distribution (Applied), Equitable apportionment, Piping systems, Relative rights, Water users, Usufructuary right.

Plaintiff grantee sought to enjoin defendant grantee from piping water from a commonly owned spring to his barn and house. Plaintiff contended that the deed from defendant grantor to her limited the use of the spring water to those uses existing at the time of the delivery of the deed. Defendant grantor contended that the provisions of the deed established only that both parties were to retain equal rights to use the spring water for domestic uses and that no limitations were imposed as to specific existing uses. The court, in denying the injunction, held that the deed established only equal rights to water for domestic use and imposed no limitations as to specific uses at the time of the deed. (Quesada-Florida) W71-01569

REGULATION OF POLLUTION BY MINE WASTES.

Pa Stat Ann tit 35, secs 691.311, thru 691.317 (1964), as amended, (Supp 1969).

Descriptors: *Pennsylvania, *Acid mine water, *Diversion, *Water pollution control, Regulation, Legislation, Legal aspects, Administrative agencies, Eminent domain, Condemnation, Easements, Mine water, Industrial wastes, Coal mine wastes, Costs, Pollution abatement, Water pollution sources, Waste disposal, Right-of-way, Waste water disposal, Mining. Identifiers: Penalties (Civil).

The Sanitary Water Board is empowered to acquire, by condemnation or purchase, such easements of rights-of-way as are necessary to prevent the pollution by acid mine drainage of 'clean waters' by diverting such drainage into polluted or unclean waters. The state shall pay the cost of acquiring such easements and of such equipment as may be necessary to divert the acid mine drainage. The condemnation procedure is set forth. A plan for the disposal of acid mine drainage must be submitted by all coal mining operations to the Sanitary Water Board for approval. Failure to submit such a plan is punishable by fine and/or imprisonment. Any corporation that has been ordered by the Board to cease discharging industrial waste into waters of the state when such order materially affects the operations of that corporations' business may apply to the Board for an order that recognizes the applicant's special interest in a specific piece of land that is necessary for the elimination of the corporation's pollution of the state's waters. Such an order vests in the corporation the right of eminent domain. (Sisserson-Florida) W71-01570

UNITED STATES V 25.88 ACRES OF LAND (TITLE TO UNDERWATER LAND).

49 F Supp 250-257 (ED NY 1943).

Descriptors: *New York, *United States, *Ownership of beds, *Condemnation, Land tenure, Eminent domain, Legislation, Docks, Bulkheads, Bulkhead line, Piers, Land forming, Riparian land, Governments, Grants Patents, Public rights, Judicial decisions, Legal aspects, State governments, Beds under water.

In a condemnation proceeding by the United States, the state of New York challenged the title of the defendant, who was the alleged owner of the land in question. Defendant claimed title through state patents to his ancestor. The state argued that land under water was held in trust for all the citizens of the state and that the state could not divest itself of title to such property. The state further claimed that the land was no longer being used pursuant to the original grants and that title therefore had reverted to the state. Citing a long line of similar cases, the United States District Court, Eastern District of New York, ruled that title had properly been granted to defendant's predecessor and that the land had not reverted to New York through abandonment of the original purpose of the patents. (Barker-Florida) W71-01571

STATE V HELLER (RIPARIAN OWNER'S RIGHT TO BATH IN MUNICIPAL WATER SUPPLY).

123 Conn 492, 196 A 337-343 (1937).

Descriptors: *Connecticut, *Riparian rights, *Swimming, *Municipal water, Relative rights, Reasonable use, Streams, Non-consumptive use, Water pollution, Recreation, Eminent domain, Legislation, Water pollution control, Public health, Environmental sanitation, Social aspects, Water quality, Riparian waters, Judicial decisions, Legal aspects, Governments, Remedies, Water quality control, Water supply. Identifiers: *Police power.

Defendant landowner was arrested for bathing in a stream which ran through his land and which was tributary of a municipal reservoir. Defendant claimed that the statute which prohibited bathing in tributaries of public water supplies was an interference with his riparian rights. He further contended that such an interference constituted a compensable taking of property by the state. The state argued that the statute was a reasonable exercise of its police powers in an attempt to protect public health. The Supreme Court of Errors of Connecticut, in affirming defendant's conviction, ruled that even though a riparian owner has a right to ordinary and reasonable bathing, public health protection may require such right to be curtailed. Such

a curtailment is not an exercise of eminent domain for which compensation is required, but merely a valid exercise of the state's police powers. (Barker-Florida) W71-01572

UNITED STATES V BIG BEND TRANSIT CO (TITLE TO CONDEMNED LAND ON INDIAN RESERVATION).

42 F Supp 459-475 (ED Wash 1941).

Descriptors: *United States, *Land tenure, *Condemnation, *Administrative decisions, Administrative agencies, Federal government, Permits, Prior appropriation, Water rights, Legislation, Federal Power Act, Dams, Damsites, Indian reservations, Judicial decisions, Legal aspects, Eminent domain, Condemnation value.

In order to construct the Grand Coulee Dam, the United States condemned certain tracts of land on the Spokane River. The river formed the southern boundary of the Spokane Indian Reservation, and one of the condemned tracts was located on the reservation. Defendant transit company claimed title to this tract on the basis of an earlier approval by the Secretary of Interior of defendant's application for the acquisition of such land for use as a power dam site. Plaintiff claimed that such approval was insufficient to convey an interest in the land, that any interest which defendant might have acquired had since reverted to the government because of defendant's delay in constructing a dam, and that any interest defendant might have had was repealed by the Federal Power Act of 1920. The United States District Court, Eastern District of Washington, rejected all of plaintiff's arguments and ruled that defendant had a valid interest in the condemned tract. The question of the value of the interest was to be submitted to a jury. (Barker-Florida) W71-01573

LAW OF THE SEA--THE CONTINENTAL SHELF--UNITED STATES PROPRIETARY CLAIM TO THE CONTINENTAL SHELF GIVES RISE TO A NEW PUBLIC DOMAIN,

Gregory M. Lattimer.

5 Land and Water L Rev 509-516 (1970). 8 p, 33 ref.

Descriptors: *United States, *Continental shelf, *Reefs, *Ownership of beds, Natural resources, Water resources, Coral, Submerged Lands Act, Tidal waters, Oceans, Water law, Law of the sea, Governments, Federal government, Legislation, Atlantic Ocean, International law, Treaties, International waters, Dredging, Landfills, Islands, Judicial decisions, Florida, Legal aspects.

This case note traces the law of international waters as it has developed in the United States from the Truman Proclamation to the case of United States v Ray, 294 F. Supp. 532 (S.D.Fla. 1969). After outlining the development of three ocean zones, the three-mile territorial zone, the high-seas zone, and the nine-mile buffer zone, the note discusses the authority of nations over the subsurface of ocean bottom, and the effects of the Submerged Lands Act and the Continental Shelf Act. The note then discusses the reasoning and probable effects on international law of the instant case, in which two developers contended they were free to develop certain reefs outside the three-mile limit of the United States. For policy reasons the court had held that the reefs were natural resources rather than islands, thereby subjecting them to government regulation. (Liptak-Florida) W71-01574

WHAT CONSTITUTES A VIOLATION OF THE PROHIBITION, IN THE OIL POLLUTION ACT OF 1924 (33 USC 431 ET SEQ), OF DISCHARGE OF OIL INTO NAVIGABLE WATERS AND ADJOINING SHORELINES,

J. F. Ghent.

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

Annot, 2 ALR Fed 794-802 (1969). 9 p, 18 ref.

Descriptors: *Water pollution control, *Legislation, *Oil, *Ships, Water pollution, Water pollution sources, Pollution abatement, Oily water, Admiralty, Navigation, Navigable waters, Transportation, Federal government, Legal aspects, Judicial decisions, Regulation, Oil wastes, Water quality control.

Identifiers: *Oil Pollution Act.

This annotation collects and analyzes ten cases in which the courts have developed the criteria for determining whether a discharge of oil into United States' navigable waters is a violation of the Oil Pollution Act of 1924. After reproducing the text of the Act, the annotation discusses the three general rules that have emerged from the cases. First, the Act prohibits any avoidable oil discharge, the amount of oil not being the test of guilt. Second, even unintentional discharges are prohibited unless they result from an unavoidable accident or collision. Finally, the defense of 'unavoidable accident' is available only in the absence of negligence. (Liptak-Florida)

W71-01575

GARLAND LEVEE DIST V HUTT (LEVEE DISTRICT'S LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF LEVEE).

183 SW2d 296-298 (Ark 1944).

Descriptors: *Arkansas, *Flood damage, *Levees, *Condemnation value, Water injury, Flooding, Rivers, Legislation, Legal aspects, Judicial decisions, Adjudication procedure, Easements, Right-of-way, Eminent domain, Condemnation, Compensation, Remedies, Damages, Flood control, Flood protection, River regulation, Shore protection, Flood water, Administrative agencies.

Identifiers: *Levee districts.

Plaintiff landowners brought suit against defendant levee district to recover damages for a taking of land for the construction of a new levee. Plaintiffs contended that they were entitled to the value of the land left between the old and new levees (as a basin to absorb flood waters) as well as the value of the land actually used for levee construction. Defendant argued that the choice of location for the levee was a discretionary decision, not subject to review by the court, and that compensation was only necessary for the land actually taken. Modifying a judgement for plaintiffs, the court held that, although the selection of the new levee's location was not subject to review, plaintiffs were entitled to recover for the imposition of a flood easement upon their land. (Liptak-Florida)

W71-01576

LEITCH V SANITARY DIST OF CHICAGO (RIPARIAN RIGHT TO UNOBSTRUCTED FLOW OF RIVER).

369 Ill 469, 17 NE2d 34-37 (1938).

Descriptors: *Illinois, *Riparian rights, *Natural flow, *Obstruction to flow, Navigable river, Sewers, Bridges, Navigable waters, Streams, Natural flow doctrine, Riparian land, Judicial decisions, Cities, Legal aspects, Water law, Water districts, Alteration of flow, Appropriation, Eminent domain, Condemnation, Riparian waters, Adjudication procedure.

Plaintiff riparian owners sued to enjoin defendant city sanitary district from obstructing the flow of a navigable stream by the construction of a sewer and a bridge. Plaintiffs contended that the filling in of the channel for the construction would interfere with their right to the natural flow of the stream and that such a right was property which could not be destroyed without just compensation. Reversing an order dismissing the complaint, the court stated that the facts alleged clearly showed that plaintiffs were riparian owners, were entitled to the unobstructed flow of natural streams, and that defend-

dant could only acquire those riparian rights by the exercise of its eminent domain powers. (Liptak-Florida)

W71-01577

I. COMPREHENSIVE PLAN FOR THE FOX RIVER WATERSHED, CH 14 (SURVEY OF LEGAL ASPECTS OF WATERSHED DEVELOPMENT).

Southeastern Wisconsin Regional Planning Comm, Planning Report No 12, Vol 1, ch 14 (1969). 24 p, 52 ref.

Descriptors: *Wisconsin, *Watershed management, *Water resources development, *Water law, Flood control, Water management (Applied), Watersheds (Basins), Water quality control, Water pollution control, Governments, Cities, Local governments, State governments, Sewage districts, Water pollution sources, Sewage disposal, Drainage districts, Drainage practices, Surface water, Surface runoff, Groundwater, Riparian rights, Legal aspects, Planning.

A legal study of Wisconsin water law begins with: a general summary of water law; the classifications of water into surface, diffused, ground, percolating, and spring water; and riparian and non-riparian rights to the use of water. Floodland regulation is discussed by defining flood channel, floodway, and flood plains, and discussing the regulatory means available at the state and local levels—including zoning, subdivision regulation, and building codes. Pollution control is discussed and the regulatory measures used by federal, state, and local governments are outlined, as well as potential enforcement by private actions. The study then outlines the legislative authority available to districts desiring to construct flood facilities. Finally, specific legal problems in the Fox River watershed are pointed out. These include backwater damage, boundary determination, diversions, and private dams which have become 'natural conditions' through long usage. (Liptak-Florida)

W71-01578

ROE V CITY OF MIDDLETOWN (MUNICIPALITY'S LIABILITY FOR DAMAGE RESULTING FROM FILLING OF CHANNEL).

262 App Div 231, 28 NYS2d 803-806 (1941).

Descriptors: *Channels, *New York, *Cities, *Obstruction to flow, Streamflow, Drains, Alteration of flow, Water fights, Judicial decisions, Legal aspects, Construction, Riparian rights, Public benefits, Barriers, Diversion, Remedies, Flooding, Cutoffs, Floodways, Ditches, Conduits, Local governments, Streams, Surface drainage, Water conveyance, Streambeds, Channel flow, Discharge (Water).

A stream, passing through plaintiff's premises, frequently overflowed, damaging plaintiff's buildings. Defendant city constructed a new channel for the stream under the street which paralleled the old channel and plaintiff's premises. Street drains emptied deposits into the old channel from the street. Defendant placed fill in the upstream portion of the old channel down to a bulkhead which was constructed on plaintiff's boundary line. Plaintiff brought an action for damages and permanent injunction to compel the removal of all fill from the old channel. Plaintiff alleged that defendant's acts caused water to collect on plaintiff's premises. Plaintiff also alleged that defendant unlawfully obstructed the flow of the stream. The Supreme Court of New York, in modifying a lower court's judgment for plaintiff, compelled defendant to restore and perpetually keep the old channel at its original flow level along plaintiff's premises. The court stated that defendant was liable for injuries to plaintiff's buildings resulting from filling of the old channel, and would be required to keep the old channel clean in the future where street drains emptied into it. (Powell-Florida)

W71-01579

SQUAW ISLAND FREIGHT TERMINAL CO V CITY OF BUFFALO (RECOVERY OF DAMAGES FOR CITY'S POLLUTION OF RIVER).

165 Misc 722, 1 NYS2d 589-595 (1938).

Descriptors: *New York, *Water pollution, *Riparian rights, *Sewage, Sewage disposal, Sewers, Legal aspects, Judicial decisions, Sands, Gravels, Cities, Riparian waters, Rivers, Navigable waters, Lake Erie, Permits, Dredging, Land, Land tenure, Local governments, Municipal wastes.

Identifiers: *Uplands.

Plaintiff riparian owner sought damages and injunctive relief against defendant municipality for pollution of the Niagara River adjacent to plaintiff's property. Plaintiff alleged destruction of sand and gravel deposits on its land under water, which it dredged for commercial purposes, and permanent damage to its uplands. Defendant argued that plaintiff could not recover because it held no federal license to dredge. The trial court gave judgment for defendant. The appellate division reversed and entered an interlocutory judgment for plaintiff. The Supreme Court affirmed the appellate division and assessed damages. The court stated that the right of plaintiff as a riparian owner to dredge its land is absolute, and that a federal license to dredge was not necessary. The court accepted the trial court's determination of plaintiff's ownership of lands under water and assessed the damages for destruction of the sand and gravel. It also determined damages to plaintiff's uplands, but found that the evidence did not show permanent damage. Since the construction of a new power project was in progress which would obviate pollution in the future, there was no reason to grant plaintiff injunctive relief. (Duss-Florida)

W71-01580

SEGARS V CITY OF CORNELIA (EASEMENT TO DISCHARGE SEWAGE).

4 SE2d 60-63 (Ga Ct App 1939).

Descriptors: *Georgia, *Easements, *Water pollution, *Water pollution sources, Riparian rights, Legal aspects, Judicial decisions, Streams, Riparian land, Real property, Air pollution, Wastes, Municipal wastes, Cities, Local governments, Impaired water quality, Path of pollutants, Pollution abatement, Water pollution effects, Domestic wastes, Sewage, Waste water disposal.

Defendant city discharged large amounts of sewage into a stream running through plaintiff's property. Plaintiff, who sought damages and injunctive relief from such discharge, offered testimony indicating that: (1) pollution of the stream resulted in serious contamination of springs and smaller streams on his property; (2) the shores of the stream were encrusted with noxious materials when the stream overflowed; (3) noxious odors resulted from the sewage; and (4) plaintiff's land was rendered unfit for residence or rental. Plaintiff contended that he was entitled as a riparian owner to pure water. Defendant contended that under a lost written agreement plaintiff's grantor had granted to the city the right to discharge sewage into the stream. On appeal from the trial court's judgment for defendant, plaintiff contended that parol evidence should not have been admitted to prove the contents of the lost agreement. The court, in affirming, ruled that the contents of a lost writing may be established by parol. Plaintiff took title to his land subject to an easement in defendant created by plaintiff's grantor. Plaintiff was bound by such easement even though he had no notice of it. (Dye-Florida)

W71-01581

G L WEBSTER CO V STEELMAN (ABATEMENT OF STREAM POLLUTION CAUSED BY CANNERY).

1 SE2d 305-316 (Va 1939).

Descriptors: *Virginia, *Water pollution effects, *Organic wastes, *Drainage water, Legal aspects,

Judicial decisions, Damages, Tidal waters, Water pollution, Odor, Sediments, Sediment transport, Organic matter, Waste water disposal, Public rights, Ditches, Streams, Vegetable crops, Drainage, Navigable waters, Judicial decisions, Legal aspects, Pollution abatement.
Identifiers: *Nuisance (Public).

Plaintiff sued for damages to his property caused by odor resulting from drainage from defendant's vegetable canning plant. Fresh water used to clean raw vegetables at the plant was filtered to remove solid particles. After filtration, it flowed into a ditch and then into a creek emptying into tidewaters bordering plaintiff's land. Alteration of the ditch to improve flow caused organic sediment from the filtration process to reach the tidelands, creating a stench at low tide and killing fish. In the lower court, plaintiff recovered on a nuisance basis, and the appellate court affirmed, finding that defendant plant, although large and important to the county, was not connected with a public interest. Thus defendant did not have a public right to drain its refuse across plaintiff's land. Defendant was operating in a private capacity without special privilege and thus had a responsibility not to injure others. Further, the right to drainage did not include the right to pollute. (Morris-Florida)
W71-01582

SEGARS V CITY OF CORNELIA (CITY'S LIABILITY FOR WASTE POLLUTION OF STREAM).

193 SE 794-796 (Ga Ct App 1937).

Descriptors: *Georgia, *Municipal wastes, *Water pollution effects, *Remedies, Cattle, Legal aspects, Judicial decisions, Damages, Water pollution, Wastes, Water sources, Springs, Local governments, Streams, Odor, Riparian rights, Sewage, Crops, Corn (Field), Hay, Cities, Adjudication procedure.
Identifiers: *Nuisance.

Plaintiff farm owner sued for damages to his land, springs, cattle and crops allegedly caused by defendant city's depositing of sewage into a creek adjacent to his land. As a result of the pollution, plaintiff's crops were unmerchantable, the cattle would no longer drink the water from the stream or springs, nor would they eat the crops, the air was befouled and plaintiff had to abandon his home. The court reversed a decision sustaining defendant's demurrer, finding that the complaint alleged a cause of action for a continuing nuisance. The court stated that damages should also lie for the reduced rental value of the property. (Morris-Florida)
W71-01583

KNIGHT V ROGERS (TITLE DISPUTE TO ACCRETIONS IN NAVIGABLE RIVER).

151 SW2d 669-672 (Ark 1941).

Descriptors: *Arkansas, *Accretion (Legal aspects), *Boundary disputes, *Islands, Land tenure, Real property, Boundaries (Property), Judicial decisions, Legal aspects, Riparian land, Land forming, Navigable rivers, Navigable waters, Streams, Legislation, State governments, Bank erosion, Ownership of beds.

In an action of ejectment, one of the grounds of plaintiff's claim of title was that a state statute provided that title to any land formed in navigable waters and within the original boundaries of a former owner of land on such a stream would vest in that former owner. As to that contention, the court held that the statute was intended to apply only to the formation of islands, whereas the land in dispute was formed by accretion to defendant's property. (Liptak-Florida)
W71-01584

HUMPICH'S TRUSTEES V LOUISVILLE GAS AND ELEC CO (POWER COMPANY'S LIABILITY FOR BACKWATER FLOODING CAUSED BY FEDERAL DAM PROJECT).

269 Ky 558, 108 SW2d 509-511 (1937).

Descriptors: *Kentucky, *Flood damage, *Backwater, *Dams, Flooding, Water injury, Hydroelectric plants, Compensation, Eminent domain, Condemnation, Damages, Remedies, Judicial decisions, Federal government, United States, Legal aspects, Electric power, River regulation, Rivers, Ohio River, Riparian land.

Plaintiff landowner brought action against defendant power company to recover for flooding of plaintiff's property by the Ohio River. Such flooding resulted from the erection of a federal dam project. Plaintiff contended that defendant's power plant called for additional elevation of the dam and that this extra height caused the flooding of plaintiff's land. Defendant admitted the flooding but argued that the federal government was in complete control of the water level at all times and that defendant was in no way responsible for the flooding. Affirming a judgment for defendant, the court held that defendant was simply a licensee and that the federal government had complete control of, and therefore sole liability for, fluctuations in the water level above the dam. (Liptak-Florida)
W71-01585

TURK V WILSON'S HEIRS (TITLE DISPUTE TO ACCRETION FORMED IN MISSISSIPPI RIVER).

266 Ky 78, 98 SW2d 4-15 (1936).

Descriptors: *Accretion (Legal aspects), *Boundaries (Property), *Islands, *Kentucky, Mississippi River, Real property, Judicial decisions, Boundary disputes, Legal aspects, Ownership of beds, Land tenure, Prescriptive rights, Navigable rivers, Governments, State governments, Erosion, Land forming, Grants, Overlying proprietors, Beds under water.

Plaintiff landowners sued defendant landowners to recover property which was in defendant's allegedly wrongful possession. Plaintiffs' ancestor had acquired an island in the Mississippi River by patent and claimed title to substantial accretions which had since formed additions to the island. Plaintiffs argued that the original patent conveyed title to the river bed to midstream, and therefore when part of that bed became high and dry, title was vested in the upland owner. Defendants claimed title by junior patents from the state and also claimed adverse possession, arguing that actual adverse possession of part of the accreted land implied constructive adverse possession of the whole. Affirming a judgment for plaintiffs, the court held that title to accretions normally vests in the upland owner, especially when his patent conveys title to midstream. (Liptak-Florida)
W71-01586

ADAMS V ELLIOTT (RIPARIAN OWNER'S LIABILITY FOR INJURIES ARISING OUT OF AUTO COLLISION WITH IMPROPERLY LIGHTED PIER).

174 So 731-736 (Fla 1937).

Descriptors: *Florida, *Highways, *Beaches, *Right-of-way, Legislation, Judicial decisions, Legal aspects, Riparian rights, Riparian land, Piers, Coasts, Coastal structures, Piles (Foundations), Recreation, Shores, Access routes, Damages, Remedies.

Plaintiff brought action against defendant riparian owner to recover damages for injuries sustained when plaintiff's car collided with a piling which supported defendant's pier. Such pier extended over a beach which was used as a public highway. Plaintiff contended that defendant negligently maintained the pier by failing to provide proper lighting or other warnings of the pier's presence.

Defendant argued that the pier was properly lit, that plaintiff was contributorily negligent in speeding and joy-riding on the beach and that the beach was not a public highway. Affirming a judgment for plaintiff, the court held that, although a riparian owner has a right to maintain a pier as a means of access to the ocean, if the legislature designates a portion of the shore for use as a public highway, the riparian owner will be liable for any negligence resulting in injuries to members of the public using the beach for highway purposes. (Liptak-Florida)
W71-01587

MISSISSIPPI EX REL RICE V STEWART (DISTINCTION BETWEEN FRESH WATER STREAMS AND TIDE-WATER STREAMS AS TO OWNERSHIP OF BEDS).

185 So 247-249 (Miss 1939).

Descriptors: *Mississippi, *Riparian rights, *Ownership of beds, *Streambeds, Legal aspects, Riparian land, Judicial decisions, Boundaries (Property), High water mark, Streams, Navigable waters, Tidal waters, Tidal effects, Intertidal areas, Adjudication procedure, Beds under water, Taxes.

Appellee riparian owners sought to assert res judicata in a suit brought by appellant State of Mississippi involving taxation of streambeds abutting their land. Appellees contended that no distinction should be made between rights of riparian owners in the beds of fresh water streams and those of abutting owners in the beds of inland tide-water streams when such distinction is made without regard to navigability in fact. Appellants contended that such distinction should exist; and by case law, a riparian owner of a fresh water stream owns the bed to the center of the stream. The Supreme Court of Mississippi held that stare decisis compelled the distinction between fresh water streambeds and tide-water stream beds. Consequently, the court found that since appellees were the owners of lands abutting a fresh water stream, they owned the beds in question and were liable for taxes on them. (Quesada-Florida)
W71-01588

SHARP V LEARNED (BOUNDARY BETWEEN STATES WHEN THE RIVER THREAD CHANGES).

188 So 302-305 (Miss 1939).

Descriptors: *Mississippi, *Boundaries (Property), *Islands, *Mississippi River, Rivers, State jurisdiction, State governments, Lumbering, Judicial decisions, Legal aspects, Louisiana, Real property, Land tenure, Boundary disputes.
Identifiers: *Thread of the stream.

Plaintiff timber cutter sought to enjoin defendant riparian landowner from prosecuting a suit against plaintiff in Louisiana courts for cutting timber. The island upon which the timber was cut was in the Mississippi River. The mainstream of the river had changed from the Louisiana side of the island to the Mississippi side. Therefore, defendant contended that the island was now in Louisiana rather than Mississippi. The court stated that the boundary line of a navigable river between two states is the thread of the stream, adding that the boundary varies with the thread. However, the court noted an exception to this general rule that when the thread changes, and flows between land and the state to which it belongs, the land remains the territory of the state, and the state boundary continues to be the old thread. Consequently, the court held that the island was still in Mississippi, and affirmed the decision of the lower court for plaintiff. (Hart-Florida)
W71-01589

CAPLES V TALIAFERRO (OWNERSHIP OF SUBMERGED LANDS).

197 So 872-875 (Fla 1940).

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Descriptors: *Florida, *Administrative agencies, *Riparian land, *Ownership of beds, Beds, State governments, Beds under water, Bays, Judicial decisions, Legal aspects, Real property, Land tenure.

Identifiers: *Submerged lands.

In a suit to quiet title to riparian and submerged lands, the court held that where a riparian landowner purchased submerged land in front of his upland from the Trustees of the Internal Improvement Fund, and later mortgaged the upland except for a narrow beachfront strip, the mortgagee was not entitled to the submerged lands upon foreclosure. (Hart-Florida)

W71-01590

ANDERSON-TULLY CO V CAMPBELL (BOUNDARY DISPUTE AS TO OWNERSHIP OF ACCRETION).

10 So 2d 445-447 (Miss 1942).

Descriptors: *Boundary disputes, *Mississippi, *Accretion (Legal aspects), *Boundaries (Property), Legal aspects, Navigable rivers, Mississippi River, Meanders, River beds, Banks, Shores, Judicial decisions, Riparian rights, Real property, Damages.

Plaintiff, owner of riparian property formed by accretion, sought to enjoin defendant timber company from cutting timber on his property. Defendant contended that the disputed strip of riparian land was deeded to it by a common grantor. Plaintiff contended that the land in question was excepted from the grant to defendant and was later granted to him after being enlarged through accretion. The Supreme Court of Mississippi held that the land in question was excepted from the grant to defendant by the common grantor and was later conveyed to plaintiff. The court issued a permanent injunction against defendant but disallowed the damages given to plaintiff by the trial court other than the actual value of the trees cut. (Quesada-Florida)

W71-01591

BRIDGEHEAD LAND CO V HALE (EFFECT OF EASEMENTS FOR ROAD CONSTRUCTION ON RIPARIAN RIGHTS).

199 So 361-363 (Fla 1940).

Descriptors: *Florida, *Riparian rights, *Roads, *Easements, Bridges, Landfills, Land forming, Road construction, Rivers, Ownership of beds, Boundaries (Property), Legislation, Administrative agencies, River beds, Riparian land, State governments, Judicial decisions, Legal aspects, Adjudication procedure, Cities, Riparian waters.

Plaintiff riparian landowner brought an action in ejectment against defendant board members of the state road department. Plaintiff had conveyed an easement to defendant across his land, which abutted a river. Defendant constructed a road on the easement, filling in the river to construct a bridge. Plaintiff sought to eject defendant from the filled portion, contending his riparian rights had been violated. The court noted that: (1) the fill was constructed on the river bed which was bested in the local municipality by a valid legislative grant; (2) full title was vested in defendant by legislation; (3) plaintiff had duly conveyed the easement to defendant; and (4) the burden was upon plaintiff to show that his riparian rights were violated. The lower court's judgment of nonsuit for defendant was affirmed since plaintiff failed to prove a violation of his riparian rights. (Hart-Florida)

W71-01592

UNITED STATES GYPSUM CO V REYNOLDS (CHANGE OF RIVER BED OVER LONG PERIOD OF TIME PRESUMED TO BE BY EROSION AND ACCRETION).

18 So 2d 448-450 (Miss 1944).

Descriptors: *Mississippi, *Accretion (Legal aspects), *Bank erosion, *Boundaries (Property), Avulsion, Banks, Boundary disputes, Navigable rivers, Legal aspects, Judicial decisions, Equitable apportionment, Riparian land, Riparian rights, Mississippi River, River beds, River training, Meanders.

Plaintiff riparian owners filed a suit seeking to have the ownership of accretions formed by the changing of a river's course over a period of years established in their favor. Defendants, owners of the opposite bank, contended that there was no evidence of accretion by gradual change, but rather that there was an avulsion by which the river made a complete departure from its original course for a short time. Defendants contended that they were entitled to ownership of the dry bed before the river returned to its old bed. Plaintiffs contended that there was gradual erosion and accretion that preceded the avulsion, and that they were the owners of the allegedly accreted land in question when the river returned to its former bed. The Supreme Court of Mississippi held that a presumption of gradual erosion and accretion exists when a river gradually changes course, and therefore plaintiffs had acquired title to the land in question before the avulsion. (Quesada-Florida)

W71-01593

STRECKFUS STEAMERS, INC V FOX (RIGHT OF STATE TO TAX SALES ABOARD STEAMBOAT IN NAVIGABLE RIVER).

14 F Supp 312-317 (SD W Va 1936).

Descriptors: *West Virginia, *Taxes, *Navigable rivers, *State governments, Legal aspects, Legislation, Judicial decisions, Boundaries (Property), Admiralty, Low water mark, Boats, Ohio River, Navigation, Interstate rivers, State jurisdiction, Federal jurisdiction.

Plaintiff corporation sought to enjoin the collection of state sales and license taxes on business conducted aboard its steamboat while crossing the Ohio River. Three contentions were made by plaintiff: (1) since the Ohio River forms the boundary between West Virginia and Ohio, the excursions were in interstate commerce; (2) the levying of taxes in the river was beyond the power of West Virginia because of a territorial ordinance; and (3) the United States had exclusive jurisdiction over a navigable river. Defendant tax commissioner contended that the taxes imposed were only for those sales made within the boundaries of the state and that states had concurrent jurisdiction over navigable rivers. The tax commissioner further asserted that the excursions did not constitute interstate commerce. The court held that: (1) Plaintiff did not bear the burden of showing the trips to be within interstate commerce; (2) West Virginia did have the power to tax sales on navigable waters within its boundaries but not in Ohio; and (3) the jurisdiction of the United States over navigable rivers is exclusive only with respect to navigation and interstate commerce. The court denied the injunction to restrain the collection of all taxes except those levied on sums derived from the sale of tickets in Ohio. (Quesada-Florida)

W71-01594

UNITED STATES V CARROLL OIL TERMINALS, INC (ACCIDENTAL OIL LEAKAGE CAUSED BY STORM DAMAGE).

18 F Supp 1008-1009 (ED NY 1937).

Descriptors: *New York, *Water pollution sources, *Pollutants, *Oil wastes, Harbors, Legislation, Pollution abatement, Legal aspects, Judicial decisions, Water quality control, Standards, Admiralty, Ships, Ports, Inland waterways, Piers, Oily water, Federal government, Federal jurisdiction.

Plaintiff United States brought suit against defendant corporation charging it with unlawfully discharging oil into New York Harbor in violation of federal statutes. Defendant contended that the oil leakage occurred as a result of storm damage to

its vessel while such vessel was properly moored. The court held that the spill resulted from circumstances beyond the defendant's control, and therefore defendant was found not guilty. (Quesada-Florida)

W71-01595

THE WATUPPA (VESSEL LIABLE FOR DUMPING WASTE OUTSIDE AUTHORIZED AREA).

19 F Supp 493-494 (SD NY 1937).

Descriptors: *New York, *Dredging, *Disposal, *Solid wastes, Waste dumps, Water pollution sources, Legal aspects, Judicial decisions, Quality control, Standards, Harbors, Water pollution control, Legislation, Pollution abatement, Pollutants.

Plaintiff United States brought action against defendant steamtug and scow for dumping of dredged material outside of designated dumping grounds. Defendant steamtug contended that its function was only to tow the scow to the dumping and therefore it should not be liable. Defendant scow stipulated its liability but contended that it was accidental and not due to faulty equipment. The court held that the tug's activity was unrelated and hence it was not liable. The court held defendant scow liable but, due to the accidental nature of the incident, it was fined the minimum amount. (Quesada-Florida)

W71-01596

UNITED STATES V APPALACHIAN ELECTRIC POWER CO (NAVIGABILITY OF RIVERS IN RELATION TO INTERSTATE COMMERCE).

23 F Supp 83-117 (WD Va 1938).

Descriptors: *Virginia, *Hydroelectric plants, *Navigable waters, *Interstate rivers, Federal government, Federal jurisdiction, Federal-state water rights conflicts, Hydroelectric project licensing, Industries, Judicial decisions, Jurisdiction, Legal aspects, Legislation, Public rights, Relative rights, Interstate commissions, State governments, Watercourses (Legal), Supervisory control (Power), Federal Power Act, Navigation.

Defendant power company had commenced construction of a dam across a stream which it contended was non-navigable. Defendant further contended that if the stream were found to be navigable, it was nevertheless located entirely within the State of Virginia and not subject to the jurisdiction of plaintiff United States. Plaintiff sought to enjoin further construction, contending that the stream was navigable and that since a navigable river into which it emptied crossed state lines, it was involved in interstate commerce. In a lengthy opinion consisting mainly of fact details, the court concluded that navigability is a fact question based on whether the stream is susceptible of being used in its ordinary condition as a highway for commerce over which trade and travel may be conducted in customary modes of trade and travel on water. The stream must be tested in its natural condition and may not be given the status of navigability by legislative declaration. In view of the evidence presented, the court held that the stream in question was both non-navigable and intrastate. (Clark-Florida)

W71-01597

ISELIN V LA COSTE (TITLE TO ACCRETIVE LANDS).

55 F Supp 977-981 (WD La 1944).

Descriptors: *Louisiana, *Boundary disputes, *Accretion (Legal aspects), *Avulsion, Thalweg, Boundaries (Property), Judicial decisions, Legal aspects, River beds, Mississippi River, Navigable waters, River flow, Meanders, Mississippi, Alteration of flow, Obstruction to flow, Remedies, Channels.

Plaintiffs, Louisiana residents, sought by declaratory judgment to establish their ownership in certain accreted lands. Plaintiffs alleged that the lands had

suddenly appeared on the Louisiana side of the Mississippi River as a result of the river's suddenly shifting course during high water. Defendants argued that the formation of the land was gradual and natural and, as a result, should belong to the state of Mississippi. The United States District Court, Western District of Louisiana, agreed with defendants and stated that, where the main channel of a stream forms the boundary between states and gradual changes occur in topography of banks or islands, the main channel of the stream continues to be the boundary. Where avulsion occurs and the course of the stream suddenly changes, the boundary remains the old center of the bed. Here, the shift was gradual and the boundary line followed the thread of the stream. Therefore, the accretion became property within the state of Mississippi. (Barnett-Florida)
W71-01598

COMMONWEALTH V PHILADELPHIA AND READING IRON AND COAL CO (POLLUTION OF WATER SUPPLIES AS PUBLIC NUISANCE).
50 Pa D and C 411-422 (1943).

Descriptors: *Pennsylvania, *Water supply, *Public rights, *Coal mine wastes, Legal aspects, Judicial decisions, Remedies, Water pollution, Wastes, Water sources, Public health, Navigation, Navigable rivers, Tributaries, Water pollution sources, State governments, Local governments, Pollution abatement, Municipal water, Regulation, Adjudication procedure, Beds under water.
Identifiers: *Public nuisance.

Plaintiffs, state attorney general and City of Philadelphia, sought to enjoin 24 coal companies from discharging coal silt or refuse into the Schuylkill River or its tributaries. Plaintiffs alleged that the coal pollution was endangering the health of people whose water supply was provided by the river and also was harming navigation by building up the bed of the river. On a preliminary motion, the court held that if the plaintiffs could prove defendants were responsible for the alleged conditions, defendants would be guilty of creating a public nuisance, and an injunction would issue. Property rights between private owners may be balanced, but where a fundamental public right is involved, a private right must give way. Purity of water supplies is such a fundamental public right. Defendants' contention that not all polluters were joined was not a bar to the suit; defendants might suggest others who should be added. (Morris-Florida)
W71-01599

METZ V HOFFMAN (UNLAWFUL OBSTRUCTION TO STREAMFLOW).

7 Monroe L R 34-39 (Pa Eq 1945).

Descriptors: *Pennsylvania, *Obstruction to flow, *Riparian rights, *Natural flow doctrine, Water rights, Competing uses, Relative rights, Legal aspects, Judicial decisions, Stream flow, Lakes, Ponds, Natural flow, Alteration of flow, Mill dams, Reasonable use, Remedies, Riparian land, Riparian waters, Water sources, Damages.

Plaintiff operated an ice manufacturing plant at the site of an old grist mill by means of waterpower obtained from an adjacent creek. Water in the creek flowed from an upstream lake. Defendant obstructed the flow of water from the lake, decreasing the amount of water power obtainable at plaintiff's plant by one-third. Plaintiff's rights in the water of the creek derived from a grant from the previous owner of the grist mill, who had established the right to use of the creek for water power. Plaintiff sought an injunction restraining defendant from interfering with his water rights and sought damages for his decreased capacity to produce ice. The court found that plaintiff was entitled by grant to the use of the normal flow of water from the pond. The court issued an injunction against defendant's continued obstruction of flow in the creek and as-

sessed damages against defendant for plaintiff's lost profits which resulted from the decreased flow and for plaintiff's expenses in removing the obstructions erected by defendant. (Dye-Florida)
W71-01600

WEST PENN RY V UMBEL (PROPERTY DAMAGE RESULTING FROM ROCK SLIDE; NEGLIGENCE CONTAINMENT OF WATER).
8 Fay L J 231-237 (Pa C P 1944).

Descriptors: *Pennsylvania, *Impoundments, *Earth dams, *Landslides, Safety factors, Rockfill dams, Barriers, Legal aspects, Judicial decisions, Strip mines, Standing waters, Strip mine wastes, Mining, Land use, Industrial wastes, Impounded waters, Erosion, Adjudication procedure, Railroads, Earthworks.

Plaintiff railway corporation sued defendant strip mining operators for damage to its railway tracks caused by an earth slide. Plaintiffs contended that defendants had negligently constructed earthen mounds behind which a pond of standing water had formed. Plaintiff corporation further contended that the standing water weakened the mounds by erosion and thus caused the damaging earth slide. Defendant miners contended that the construction of the mounds and the collection of water did not constitute negligence. The Court of Common Pleas for Fayette County, Pennsylvania held for plaintiffs, stating that the evidence in the trial below supported a finding of negligence by the jury. (Quesada-Florida)
W71-01601

PUBLIC SERV COMM'N V SINKING SPRING WATER CO (REQUIRING POTABLE WATER FROM SUPPLIER).

46 Dauph 9-17 (Pa Eq 1938).

Descriptors: *Pennsylvania, *Water supply, *Distribution systems, *Public health, Water pollution, Water quality, Water policy, Water loss, Administrative agencies, Legislation, Wastes, Remedies, Potable water, Artesian wells, Water sources, Springs, Legal aspects, Judicial decisions, Public rights, Public utilities, Water loss.
Identifiers: *Contempt.

Plaintiff public utility commission secured an injunction against defendant water company to force it to furnish potable water, to quit using sources not approved by the health department and to cease from distributing contaminated water. Plaintiff later asked the court to hold the defendant and its general manager in contempt for failure to comply. Defendant answered that it had attempted to comply by drilling eight wells and seeking to sell out to two boroughs. The court found that the defendant failed to eliminate unnecessary leakage which prevented an adequate supply of water from reaching homes and schools and knowingly pumped contaminated water from a spring into the distribution system, even after the health department ordered it to quit such pumping. For this and for failure to comply with the court order to provide an adequate supply of potable water to consumers, the court found defendant in contempt. (Morris-Florida)
W71-01602

COMMONWEALTH EX REL MARGIOTTI V DELAWARE DIV CANAL CO (CANAL OWNERSHIP AS AFFECTED BY BREACH OF COVENANT TO MAINTAIN AS A CANAL).

45 DAUPH 234-251 (Pa Eq 1938).

Descriptors: *Pennsylvania, *Canals, *Navigation, *Maintenance, Water law, Legislation, Judicial decisions, Legal aspects, State governments, Transportation, Water supply, Inland waterways, Railroads, Navigable waters, Recreation facilities, Parks, Remedies, Land tenure, Relative rights, Bridges, Real property, Claims (Contracts).

Plaintiff state sought to require defendant canal company to either forfeit a canal to the state for failure to operate it as a canal or to require restoration and operation of the canal. Plaintiff had sold the canal to defendant's assignor with a clause requiring the purchaser and his assignees to keep it functioning. The canal was operated for over 70 years, after which 40 miles of it were sold to the plaintiff to become a state park. The state permitted decay of the canal and lowered overhead bridges, preventing use of the canal for commercial navigation. The court found that the clause in the original sale contract was not a condition subsequent, but a covenant running with the land, which was enforceable at law. However, the court held that since the state permitted the canal's disuse, it could not force the defendant to restore it. The court also held that the defendant was entitled under a state law to use the canal to operate a water supply business. (Morris-Florida)
W71-01603

FURJANIC V METROPOLITAN EDISON CO (RELIEF FROM CANAL OVERFLOW BARRED BY LACHES).

47 DAUPH 187-189 (Pa Eq 1939).

Descriptors: *Pennsylvania, *Concrete-lined canals, *Flood damage, *Remedies, Bank erosion, Banks, Repairing, Legal aspects, Judicial decisions, Drainage water, Running waters, Surface waters, Erosion control, Bank stabilization, Overflow, Canal embankments, Adjudication procedure.

Plaintiff landowners sought to enjoin defendant corporation from permitting water to flow onto their lands. Plaintiffs alleged that defendant caused the overflow by maintaining its concrete canal embankments and adjacent ravine in a state of disrepair. Additionally, the landowners sought damages for injury to their lands and crops. Defendant contended that the plaintiffs were barred by laches. The Dauphin, Pennsylvania County Court held that, since plaintiffs had waited ten years to bring their action, they were precluded from obtaining equitable relief. (Quesada-Florida)
W71-01604

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT OF THE COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 90th CONGRESS, 1st SESSION.

Hearings—Subcom on Conservation and Credit, Comm on Agriculture, US House of Reps, Feb 15, 16, 17, June 28, 29, July 26, Nov 2, 1967.

Descriptors: *Flood protection, *Watersheds (Basins), *Project purposes, *Project benefits, Watershed management, Water resources development, Watershed Protect. and Flood Prev. Act, Flood control, Recreation, Irrigation, Water supply, Soil management, Sediment control, Structures, Channel improvement, Crop production, Grasslands, Pastures, Federal project policy, Federal government, Local governments, Financing, Project planning, Basins, Stream improvement.

Hearings before the Subcommittee on Conservation and Credit of the House Committee on Agriculture were held to consider approving watershed projects in various sections of the United States. With few exceptions, the Subcommittee sought to approve only those projects whose primary purpose was flood prevention, thereby following the policy and guidelines of the Watershed Protection and Flood Prevention Act. Such incidental benefits as recreation, irrigation and municipal water supply which were consistent with good soil and water management were considered secondary to flood prevention. Flood prevention measures included in the projects involved land treatment for watershed protection, floodwater retarding structures, stream channel improvement and debris basins for sediment control. The predominant type of land in the watersheds considered was cropland. However, watershed land use included grassland,

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woodland, pastureland and urban property. The projects exhibited planning at both the federal and local levels. Local financing supplemented the federal assistance called for in most plans. (Finman-Florida)
W71-01605

STATE EX REL O'CONNOR V SORENSON (NEW PROPERTY BOUNDARY CAUSED BY NEW HIGH WATER MARK WHEN RIVER WAS DAMMED).
271 NW 234-239 (Iowa 1937).

Descriptors: *Iowa, *Riparian land, *High water mark, *Boundaries (Property), Riparian rights, Ownership of beds, Prescriptive rights, Riparian waters, Dams, Rivers, River beds, Beds under water, Navigable rivers, State governments, State jurisdiction, Reservation doctrine, Judicial decisions, Legal aspects, Crop production.

Plaintiff state brought action against defendant riparian landowner to quiet title to submerged land. Plaintiff had dammed a river below the disputed site 20 years earlier, raising the high water mark. Defendant contended that his property extended into the river to the old high water mark. Plaintiff asserted that its title in the river bed extended to the new high water mark. The court found that: (1) the ordinary high water mark is not the line reached by unusual floods, but the line to which high water ordinarily reaches; (2) the high water mark is co-terminous with the river bed, and only the land destroyed for agricultural purposes is considered the bed; (3) the location of a high water mark is a fact question; (4) the high water mark of a navigable stream is the division between the river bed and adjoining private property; and (5) riparian rights will be acquired along the artificial channel of a natural stream. Finding that plaintiff had established title by prescription, and that defendant had acquired his title after plaintiff's damming of the river so that even his property description referred to the new high water mark, the court found title to the land in question to be in plaintiff. (Hart-Florida)
W71-01606

MERIDIAN TOWNSHIP V PALMER (PUBLIC EASEMENT ACROSS RELICTION).
279 Mich 586, 273 NW 277-280 (1937).

Descriptors: *Michigan, *Lakes, *Accretion (Legal aspects), *Riparian rights, Competing uses, Ownership of beds, Relative rights, Riparian land, Riparian waters, Usufructuary right, Navigable waters, Swimming, Public rights, Easements, Roads, Lake shores, Cities, High water mark, Low water mark, Reservation doctrine, Legal aspects, Judicial decisions.

Plaintiff township sought an injunction against defendant littoral landowner to prevent defendant from charging the public for use of a beach and to remove a fence which prevented access to a lake. Defendant owned land along a lake; a road passed along the shore through defendant's land. A reliction formed between the road and lake, and defendant began operating a commercial beach. Plaintiff did not deny defendant's ownership of the reliction, but claimed that the reliction was subject to the same public easement as the roadway because the lake was navigable. The court noted that although the riparian owner could not erect structures between the high and low water mark of the lake, the public had no right of passage over the same area, because, despite title in the state, the riparian owner had exclusive use of the reliction and could erect bathing houses for his business or pleasure. Rejecting plaintiff's contention that the public acquired an easement upon the reliction along with the roadway easement, the court affirmed the lower court's decision for defendant. (Hart-Florida)
W71-01607

WILKINSON V CITY OF INDIANOLA (OVERFLOW OF CITY SEWAGE SYSTEM).
278 NW 326-327 (Iowa 1938).

Descriptors: *Iowa, *Sewers, *Overflow, *Municipal wastes, Cities, Water injury, Drainage systems, Sewage disposal, Storm drains, Storm runoff, Rain, Rain water manholes, Public health, Judicial decisions, Legal aspects, Adjudication procedure, Damages, Surface runoff, Surface waters, Surface drainage.

Plaintiff property owner sued defendant city for damages resulting from the overflow of municipal sewage onto plaintiff's land. Defendant had opened the surface water intake to a sewer, although the sewer was solely designed for sewage disposal and was inadequate for storm sewer purposes; the sewer had overflowed onto plaintiff's land on several occasions. Plaintiff contended that defendant was negligent in opening the storm intakes. The court held that the evidence was sufficient to be presented to the jury, and affirmed the judgment of the lower court for plaintiff. (Hart-Florida)
W71-01608

SHELDON V CHAMBERS (TITLE TO SUBMERGED LAND).
281 NW 438-441 (Iowa 1938).

Descriptors: *Iowa, *Accretion (Legal aspects), *Bank erosion, *Boundaries (Property), Riparian land, Rivers, Missouri River, River flow, Flooding, Submergence, Erosion, Judicial decisions, Legal aspects, Real property, Land tenure.

Plaintiff riparian landowner brought action against defendant landowners to quiet title to riparian land. The Missouri River had covered the contested land for 10 years. Plaintiff contended the land was totally eroded by the river, ceasing to exist as lands in place, and was now his property by accretion. Defendants responded that the lands had never eroded away, and that even if total erosion had occurred, the accretion belonged to other riparian owners. The court found that mere disappearance of the land because of flooding would not suffice to destroy defendants' ownership. Furthermore, the court found that if the land had totally eroded away and accreted back, plaintiff had not established his right to the accreted land. The evidence was held to have established defendants' title. (Hart-Florida)
W71-01609

STATE V M SUPPLE AND SONS CO (STATE INTERFERENCE WITH CONSTRUCTION OF BULKHEAD NOT IN NAVIGABLE WATERS).
290 NW 139-142 (Wis 1940).

Descriptors: *Wisconsin, *Breakwaters, *Bulkheads, *Lake beds, Bulkhead line, Navigable waters, Permits, Structures, Lake shores, Lakes, Inland waterways, Relative rights, Shores, Shore protection, Waves (Water), Navigation, Water levels, Swamps, Marshes, Judicial decisions, Legal aspects.

Pursuant to a government permit and for shore protection, defendant constructed a bulkhead between a lake shore and the shallow water of the lake. Plaintiff State of Wisconsin contended the bulkhead was on a bed beneath navigable waters and that defendant could not construct anything thereon without plaintiff's consent. The court ruled that the trial court had found as a fact that the bulkhead was not on the bed of navigable waters. The evidence was sufficient to support such finding. Judgment for defendant was affirmed. (Price-Florida)
W71-01610

LATHAM V DES MOINES ELECTRIC LIGHT CO (WATER DAMAGE CAUSED BY BURSTING STORM SEWER).
296 NW 372-376 (Iowa 1941).

Descriptors: *Iowa, *Sewers, *Electrical equipment, *Water injury, Drainage systems, Storm drains, Power system operations, Electrical networks, Powerline carriers, Transmission lines, Bundled conductors, Electric power, Electric power industry, Electric wires, Underground structures, Underground, Water pressure, Judicial decisions, Legal aspects, Adjudication procedure, Damages, Surface runoff.

Plaintiff building owner sued defendant electric company for damages to his building caused by a broken sewer. Defendant had installed an electrical conduit across a sewer which was laid under the street in front of plaintiff's building. The conduit occupied the top 40% of the sewer's interior diameter. During a heavy rainfall, the sewer burst at the conduit-sewer intersection, causing the water to escape, wash away the foundation of plaintiff's building, and collapse a wall. Plaintiff contended that defendant had negligently installed the conduit so as to obstruct the sewer and that this was the proximate cause of his injury. The court stated that defendant should have used reasonable care in installing the conduit, and that defendant was negligent if it had obstructed the sewer so that injury to others was reasonably apparent. Finding that the evidence established a question for a jury, the court held that the lower court had erred in directing a verdict for defendant. (Hart-Florida)
W71-01611

HUBER V CITY OF BLUE EARTH (MERE PASSING OF CITY ORDINANCE NOT EFFECTIVE AS DEFENSE TO STREAM POLLUTION FROM SEWER).
6 NW2d 471-473 (Minn 1942).

Descriptors: *Minnesota, *Canneries, *Water pollution sources, *Legislation, Cities, Sewers, Effluents, Sewage, Outlets, Tile drains, Local governments, Water pollution effects, Water pollution control, Sewage treatment, Sewage effluents, Sewage disposal, Legal aspects, Judicial decisions, Riparian land.

Plaintiff landowner brought action against defendant city for damages caused to his riparian land by stream pollution. Defendant had allowed untreated sewage and offensive effluents from a cannery to flow through its sewers into the stream. Defendant contended that its sewer was a condition and not the proximate cause of the nuisance. Moreover, defendant denied liability for the pollution caused by the canning factory because it had passed an ordinance prohibiting the deposition of effluents through sewers. The court ruled that the city sewer was the proximate cause of the pollution and rejected the defense proffered concerning the ordinance. The liability of cities for pollution of water by sewage is well established. The city could not by mere passage of an ordinance relieve itself of its fundamental duty or delegate its responsibility for injuries to those who connected with the sewer. Based on expert testimony, the jury was capable of determining the part of the pollution for which defendant was liable and the part attributable to the factory. The judgment for plaintiff was affirmed. (Price-Florida)
W71-01612

PLATTSMOUTH BRIDGE CO V GLOBE OIL AND REFINING CO (OWNERSHIP OF ACCRETIVE LANDS).
7 NW2d 409-412 (Iowa 1943).

Descriptors: *Iowa, *Boundary disputes, *Boundaries (Property), *Accretion (Legal aspects), Legal aspects, Judicial decisions, Navigable waters, Eminent domain, Legislation, Permits, Federal government, Missouri River, Patents, Bridges, Easements, Right-of-way, Alluvium, Land tenure, Real property.

Defendant constructed a pipeline across land under plaintiff's bridge. Plaintiff contended the land was accretive land and based his claim thereto on deeds

from his predecessors and on a favorable decree in a prior quiet title suit. Plaintiff sought an injunction to restrain defendant from using its property. Defendant contended the land was not accretive land and therefore that the deeds and quiet title decree did not affect title thereto. Based on the evidence, the appellate court agreed with the trial court that the land was accretive and belonged to plaintiff. Defendant was therefore a trespassor. The judgment for plaintiff was affirmed. (Price-Florida) W71-01613

HUERTH V TOWN OF PRAIRIE DU SAC (JURY QUESTION AS TO WHETHER STATUTORY REQUIREMENTS WERE MET RELATING TO PROPER DRAINAGE).
246 Wis 25, 16 NW2d 422-424 (1944).

Descriptors: *Wisconsin, *Drainage practices, *Surface waters, *Highway effects, Marshes, Marsh plants, Percolation, Culverts, Floodwater, Gradation, Graded, Grading, Natural flow, Ditches, Seepage, Obstruction to flow, Legislation, Drains, Drainage, Drainage effects, Adjudication procedure, Judicial decisions, Legal aspects.

Plaintiff owned marshy lands on which he grew, during certain parts of the year, valuable hay. Defendant constructed a highway near plaintiff's property and provided for drainage of surface water. Plaintiff contended his land was flooded and his ability to grow hay destroyed as a result of the alleged negligent laying of the drains and the inadequate number thereof. Defendant denied such allegations. The trial court directed a verdict for defendant. The state statute on which plaintiff relied required the maintaining of culverts and outlets to permit natural drainage. The appellate court held that the evidence presented at trial was sufficient to require a jury determination. A new trial was granted. (Price-Florida) W71-01614

PLATTER V CITY OF DES MOINES (DUTY OF CITY TO MAINTAIN SEWER).
21 NW2d 787-791 (Iowa 1946).

Descriptors: *Iowa, *Damages, *Sewers, *Cities, Overflow, Levees, Floods, Rainfall, Judicial decisions, Legal aspects, Cultivated lands, Sediments, Sewage, Sewage effluents, Local governments, Flooding, Remedies, Repairing, Maintenance, Adjudication procedure.

Plaintiff brought action for damages to his property caused when a break developed in defendant's sewer line and repeatedly flooded his premises. Plaintiff contended defendant was negligent in its maintenance of the sewer and in not repairing the break after having notice of the defect. Defendant contended plaintiff had failed to prove negligence on defendant's part as to the maintenance of the sewer, had failed to show reasonable opportunity for repair of the break, and that plaintiff's proof of damages was wholly conjectural and uncertain. The court ruled in defendant's favor so far as the allegation of negligence as to maintenance of the sewer was concerned, but ruled that the evidence was sufficient to create a jury question as to whether defendant was negligent in not making the needed repairs during the time interval between the floodings. So far as property damage was concerned, there was insufficient evidence to go to the jury. However, damages as to inconvenience and obnoxious odors were ascertainable. Judgment for defendant was reversed. (Price-Florida) W71-01615

STATE V KNOWLES-LOMBARD CO (USE OF LAND BETWEEN HIGH AND LOW WATER MARKS).
188 A 275-276 (Conn 1936).

Descriptors: *Connecticut, *Boundaries (Property), *High water mark, *Low water mark, Boundary disputes, Judicial decisions, Land tenure, Legal

aspects, Proprietary power, Public rights, Relative rights, Riparian land, Riparian rights, State governments, Usufructuary rights, Access routes.

Defendant owned land adjacent to a sound and was engaged in removing and selling sand located between the high and low water marks adjacent thereto. Plaintiff state claimed that it had title to that area of the beach and that defendant had no right to remove the sand without its permission. The court held it to be well settled that the state owned that part of a beach lying between the high and low water marks. Defendant, as a riparian owner, possessed certain rights associated with access to the water. However, removal of soil between the high and low water marks was an act of ownership rather than an exercise of the right to access. The lower court decision in favor of plaintiff was affirmed. (Clarke-Florida) W71-01616

CAHILL V MAYOR AND CITY COUNCIL OF BALTIMORE (PERMIT TO CONSTRUCT WHARF INTO NAVIGABLE RIVER).
196 A 305-310 (Md 1938).

Descriptors: *Maryland, *Docks, *Permits, *Riparian rights, Piers, Navigable rivers, Rivers, Navigable waters, Riparian waters, Riparian land, Legislation, Remedies, Judicial decisions, Engineering structures, Governments, Regulation, Cities.

Identifiers: *Mandamus.

In an action for mandamus, plaintiff riparian landowner sought to compel defendant city officials to issue him a permit to construct a wharf from his property into a navigable river. Plaintiff contended that defendants' refusal to issue the permit was error in that it was based on a municipal ordinance which was invalid. Plaintiff argued that the ordinance was restrictive of the right, which had been granted by a general state statute, of riparian landowners to construct wharves. Defendants contended that the ordinance, in establishing pierhead lines, merely qualified the right granted by the statute. The court held that the statute and the ordinance were reconcilable and that the establishment of pierhead lines within the city was a legitimate qualification of the statutory right. Therefore, there was ample justification for the officials' refusal to issue the petition. The mandamus was denied. (Snow-Florida) W71-01617

GRAY V GRAY (VALIDITY OF LAND PATENTS UNDER NAVIGABLE STREAMS).

16 A2d 166-172 (Md 1940).

Descriptors: *Maryland, *Patents, *Navigable rivers, *Land tenure, Judicial decisions, Legal aspects, Legislation, Proprietary power, Land, Governments, Ownership of beds, Relative rights, Riparian land, Watercourses (Legal), Streams, Rivers, Navigable waters, Navigation.

Two disputes arose concerning the validity of patents to certain lands granted to defendants by the state. A stream, flowing across the lands in question, could in parts be traversed by small boats and in parts could not. A Maryland statute provided that no patent could be issued for land covered by navigable waters. The court after defining navigable streams as those susceptible to use as highways of commerce, held that the stream in question satisfied this definition. Therefore, the court held that no lands covered by the stream could be passed by patent. (Clarke-Florida) W71-01618

LANDIS V SEA ISLE CITY (RIPARIAN RIGHTS BETWEEN HIGH AND LOW WATER MARKS).
129 NJ Eq 217, 18 A2d 841-844 (1941).

Descriptors: *New Jersey, *Boundary disputes, *Easements, *Riparian rights, Boundaries (Property), Community development, Judicial decisions, Land tenure, Legal aspects, Leases, Local governments, Proprietary power, Relative rights, Recreation, Riparian land, Riparian waters, Public rights, High water mark, Low water mark.

Identifiers: *Dedications.

Plaintiff's predecessor in title to property located adjacent to the Atlantic Ocean dedicated an easement across his beach to public use. A New Jersey statute permitted a riparian owner adjacent to the ocean to apply for and receive from the state, a grant or lease for the lands fronting his property between the high and low water marks. In a quiet title action, plaintiff contended that such a grant or lease would not be subject to the easement dedicated to the public by his predecessor in title. Defendant city claimed the contrary. The court held that title to lands lying oceanward of the high water mark is in the state. As a riparian owner, plaintiff had no peculiar right to such lands fronting his property. He merely had a right to apply for a grant or lease from the state, which the state could grant or deny at its discretion. Plaintiff had no standing to bring a quiet title action concerning the land in question until title to it had actually passed to him from the state. (Clarke-Florida) W71-01619

TOWNSHIP OF LOWER V CITY OF WILDWOOD (STREAM AS A COMMON BOUNDARY BETWEEN TWO CITIES).

20 NJ Misc 22, 28 A2d 74-75 (1942).

Descriptors: *New Jersey, *Reservation doctrine, *Boundaries (Property), *Cities, High water mark, Low water mark, Boundary disputes, Navigable rivers, Ownership of beds, Bank erosion, State jurisdiction, Streams, Tidal waters, Judicial decisions, Legal aspects.

Plaintiff township petitioned for an appointment of commissioners to determine the location of a common boundary with defendant city. The boundary was a navigable creek. Plaintiff contended that the boundary should be monumented. The court stated that where title runs to the bank of a navigable tidal stream, the boundary could not be monumented. To arrive at this conclusion, the court noted that the municipal title ran to the high water mark, with the state reserving jurisdiction between high and low water marks. Therefore, the court found that the municipal police power did not extend past the low water mark, and hence monumenting would be superfluous. The lower court's decision for defendant was affirmed. (Hart-Florida) W71-01620

CITY OF PHILADELPHIA V PENNSYLVANIA SUGAR CO (CONTEST OVER USE OF DOCK WATER AT END OF CITY STREET).
348 Pa 599, 36 A2d 653-656 (1944).

Descriptors: *Pennsylvania, *Riparian rights, *Reservation doctrine, *Riparian waters, Ownership of beds, Beds under water, High water mark, Low water mark, Navigation, Navigable rivers, Relative rights, Riparian land, Usufructuary right, State jurisdiction, Judicial decisions, Legal aspects, Cities, Docks.

Plaintiff city brought action against defendant sugar company to recover value for the use of dock water alongside defendant's wharf. Plaintiff's street ran to the river, culminating in a public landing, and defendant's wharf was contiguous to the street and extended into the river. Defendant had not used the public landing, but only the water in front of the street. Plaintiff contended sufficient ownership of the water to maintain the action. The court found that plaintiff could not restrict the public from use of the navigable water at the landing because: (1) a riparian owner has no property rights beyond low water mark; (2) title to land

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below the high water mark is in the state; (3) title to the land of a riparian owner between high and low water mark is subject to the state's police power; (4) control over the dock space was in the state; and (5) whatever easement existed was subject to the state's police power. Noting that plaintiff had received no grant of the dock water from the state, the court concluded that plaintiff's asserted ownership was insufficient to maintain the action. The lower court's decision for defendant was affirmed. (Hart-Florida)
W71-01621

STATE V MALMQUIST (DAM OWNER'S DRAWDOWN OF LAKE AS NUISANCE).
40 A2d 534-541 (Vt 1944).

Descriptors: *Vermont, *Dams, *Drawdown, *Riparian rights, Water supply, Fish conservation, Fish migration, Fish populations, Reservation doctrine, State governments, Judicial decisions, Legal aspects, Adjudication procedure, Remedies, Water levels, Water level fluctuations, Mills.
Identifiers: *Injunction (Prohibitory), Public nuisance.

Plaintiff state sought an injunction to prevent defendant dam owner from arbitrarily drawing off water from a lake. Defendant's predecessors in interest had acquired title to the dam by legislative grant in order to raise the lake for operation of defendant's mills; however, neither mill had been operated by water power in recent years. Defendant attempted to force a littoral landowners association to buy his water rights, or give him unrestricted use of the lake water. Upon refusal, defendant attempted to intimidate the association by opening the dam. The court found that the plaintiff had standing to sue through the public interest in bathing, and through plaintiff's duty to preserve migratory and non-migratory fish for the public. The court stated that impairment of these interests was a public nuisance. Defendant contended that he had not lowered the lake below its natural level, but the court held that the artificial level had acquired such momentum that it had assumed a natural character. The legislative grant was construed to permit a reasonable use of lake water for the mills. However, non-mill use was found unreasonable and, because of defendant's threat, the injunction was granted. (Hart-Florida)
W71-01622

SQUAW ISLAND FREIGHT TERMINAL CO V CITY OF BUFFALO (RIPARIAN RIGHTS AND WATER QUALITY).

246 App Div 472, 284 NYS 598-608 (1936).

Descriptors: *New York, *Riparian rights, *Water pollution, *Sewage disposal, Water quality, Riparian waters, Judicial decisions, Legal aspects, Damages, Sewage effluents, Competing uses, Municipal water, Reasonable use, Public rights, Rivers, Streams, Navigable waters, Legislation, Shores, Beds, Wastes, Municipal wastes, Banks, Dredging, Domestic wastes, Overlying proprietors.

Plaintiff lower riparian owner sought damages and an injunction prohibiting defendant city from discharging sewage into a river in a manner which damaged plaintiff's commercial property rights. Defendant, pursuant to statutory authority, had constructed new sewer works which allegedly occasioned the damage. The lower court dismissed plaintiff's complaint, finding that plaintiff's method of dredging caused the river flow to deposit sewage on its lands. In reversing, the appellate court ruled that the state has title to the river beds, while both the state and subjects have an easement in the use of stream water. Riparian owners retain their common law riparian rights. Plaintiff was entitled to receive water from upper riparian owners without material alteration in quantity or quality. The right of defendant to construct sewage works did not make it immune from liability for damages in the absence of express authority. Plaintiff was entitled

to injunctive relief and damages. The court stated further that a balancing of injuries should not affect its determination of the case. Injunctive relief, however, could be delayed until defendant could effect the means to avoid the pollution damaging plaintiff's lands. (Duss-Florida)
W71-01623

IN RE ROCHE'S BEACH V CITY OF NEW YORK (EMINENT DOMAIN AND AWARDS FOR SUBMERGED LANDS).
250 App Div 239, 294 NYS 22-26 (1937).

Descriptors: *New York, *Eminent domain, *Condemnation value, *Beds under water, Condemnation, Legal aspects, Judicial decisions, Land reclamation, Reclamation, Land appraisal, Beaches, High water mark, Ownership of beds, Boundaries (Property), Seashores, Tidal waters, Tides, Public benefits, Cities.

Appellant appealed from a portion of condemnation proceedings which made a nominal award for one parcel of land and nominal awards for several other parcels to unknown owners instead of the appellant. The City of New York had instituted proceedings to acquire title to various land and land under water for purposes of a public beach. Appellant received awards for condemned land under water to which he proved title, but had asserted title by adverse possession to other land parcels in question. The appellate court affirmed in part and reversed in part. Appellant had established title to various land under water, and the value of this land should have been predicated upon the practicability of reclamation by artificial means and upon the likelihood of the emergence of land in accordance with the cycle of change which prevailed upon the coast. Appellant had not established title by adverse possession to several other parcels of land and was not entitled to awards for these. The court reversed and remitted for further hearing as to the nominal award for one of the parcels which bounded appellant's land. (Duss-Florida)
W71-01624

HERSHEY BEVERAGE CORP V CITY OF SCHENECTADY (MUNICIPAL LIABILITY FOR FLOOD DAMAGES).
291 NYS 256-257 (App Div 1936).

Descriptors: *New York, *Sewers, *Flood water, *Storm runoff, Judicial decisions, Legal aspects, Damages, Rainfall, Storm drains, Storms, Outlets, Drains, Cities, Maintenance, Water injury, Precipitation excess, Operation and maintenance.

Plaintiff corporation brought a negligence action against defendant city for damages which resulted from flooding of its premises. Defendant allegedly had failed to install and maintain sewers adequate to drain rainfall without flooding a particular street and had improperly installed a sewer drain in such street. From a jury verdict for defendant, plaintiff appealed. In affirming per curiam, the court held that the jury could have reasonably found that plaintiff's cellar was damp at all times, that his premises were in a low section of the city, that the sewers were adequate, that the rainfall causing the damage was of extraordinary quantity, and that plaintiff's own outlets to sewers were improperly maintained. (Duss-Florida)
W71-01625

MAYO V WINDELS (DAMAGES FOR WATER DIVERSION).
255 App Div 22, 5 NYS2d 690-696 (1938).

Descriptors: *New York, *Diversion, *Water supply, *Compensation, Riparian rights, Legal aspects, Judicial decisions, Aqueducts, Dams, Construction, Competing uses, Eminent domain, Condemnation, Damages, Cities, Rivers, Streams, Tributaries, Land, Land use, Appraisals, Mills, Hudson River, Water utilization, Usufructuary right.

Plaintiff sought to institute proceedings to determine damages to plaintiff for New York City's excess water diversion from a river. Pursuant to legislation, the city had previously constructed an aqueduct and dam to divert river water to the city. The city had paid damages to injured parties based on the total diversion of the river waters if such total diversion became necessary in the future. The total diversion was not accomplished by the original works. Many years later, pursuant to a subsequent law, the city constructed a new aqueduct and dam below the original ones which resulted in the total diversion of the river. Plaintiff sought damages for this diversion. The lower court found that the prior award for damages did not cover the subsequent diversion since the city did not acquire any rights through it to divert waters below the original dam and aqueduct. The appellate court reversed, holding that the original law and award covered all possible diversion of water. One justice dissented, finding that it was clear that the prior award covered only diversion of water by the specific dam and aqueduct constructed. It did not cover new construction below the old dams pursuant to a later legislative act. (Duss-Florida)
W71-01626

APPLICATION OF GILLESPIE (COMPENSATION TO NEIGHBORING LANDOWNER FOR CONSTRUCTION OF AQUEDUCT).
173 Misc 591, 17 NYS2d 560-564 (1940).

Descriptors: *New York, *Administrative agencies, *Eminent domain, *Compensation, Cities, Aqueducts, Damages, Legal aspects, Judicial decisions, Construction, Water supply, Tunnels, Underground water supply, Structures, Easements, Right-of-way, Land use, Depreciation, Property values.

New York City constructed an aqueduct and other structures on land separated from petitioner's land by a county road. The City also obtained a subsurface easement under petitioner's land to convey water. Petitioner claimed compensation for damages to his property by virtue of a New York law which provided that contiguous landowners to such projects could make claims. Petitioner alleged that he was inconvenienced by the project and that his property would temporarily decrease in value. Petitioner also sought compensation for change in the character of the land because of the project's proximity and for a permanent depreciation in its value. The Board of Water Supply denied petitioner any compensation for the alleged damages to his land and granted a nominal sum for the subsurface easement. The court confirmed the Board's decision, holding that the statute did not provide for relief for such damages. Furthermore, petitioner's claim of permanent depreciation was highly speculative. As for the subsurface easement, the court found that the Board's award was sufficient. (Duss-Florida)
W71-01627

ROCKLAND LIGHT AND POWER CO V CITY OF NEW YORK (DAMAGES PRESENTLY RECOVERABLE AS DEDUCTIBLE FROM TOTAL DAMAGES SUFFERED BY WATER DIVERSION).
263 App Div 284, 33 NYS2d 258-263 (App Div 1942).

Descriptors: *Hydroelectric plants, *New York, *Diversion, *Damages, Eminent domain, Alternation of flow, Judicial decisions, Legal aspects, Diversion dams, Obstruction to flow, Prior appropriation, Relative rights, Water utilization, Cities, Water control, Riparian rights, Engineering structures, Rivers, Adjudication procedure, Remedies.

Plaintiff hydroelectric company owned land, for use as a projected power development, adjacent to a river from which defendant city had appropriated water diversion rights. Above plaintiff's sites, defendant engaged in dam construction which would ultimately deplete the normal flow of water below

the dam, thus preventing plaintiff from further developing its project. Due to war conditions, the defendant's project might never be completed. Plaintiff brought an action for declaration of right to claim damages for decrease in its property value by reason of defendant's proposed water diversion. Plaintiff contended that, should the city delay cutting off the river water for many years, plaintiff would be denied the right to prosecute its claims because of statutory limitations. The Appellate Division of the Supreme Court of New York found for plaintiff and held that permitting plaintiff to recover the damages already accrued would not be unfair to the defendant since the amount so recovered would be deductible from any total damages suffered by the company when and if the city actually diverted the water. (Powell-Florida) W71-01628

SMITH V STATE (VALUATION OF PROPERTY CONDEMNED FOR HIGHWAY RELOCATION AND FLOOD CONTROL PROJECT).
48 NYS2d 58-61 (Ct Cl 1944).

Descriptors: *New York, *Condemnation value, *Highway relocation, *Flood control, Highway effects, Condemnation, Eminent domain, Compensation, Judicial decisions, Legal aspects, Adjudication procedure, Highways, Dams, Watershed management, Real property, State governments, Flooding, Property values, Land appraisal.

Plaintiff landowner brought an action against defendant state to recover damages for the appropriation of property for a flood control and highway relocation project. Plaintiff contended that he was entitled to the value of the land actually taken and the decrease, caused by the change in grade, in value of his remaining land. Plaintiff also claimed value for the general effect of the project on the neighborhood and the decreased usefulness of the property. The court awarded damages to plaintiff measured by the value of the land taken and the decreased usefulness of the remaining property. However, it held that it could not consider the general effect on the area, the change in grade, or other effects which might easily be remedied. (Liptak-Florida) W71-01629

CITY OF PHILADELPHIA V STANDARD OIL CO (RIPARIAN OWNER'S LIABILITY FOR RENT FOR USE OF CITY'S BULKHEAD).
79 F2d 764-771 (3rd Cir 1935).

Descriptors: *Bulkheads, *Rent, *River basins, *Pennsylvania, Docks, Navigable waters, Navigable rivers, Navigation, Riparian rights, Riparian waters, Coastal structures, Piers, Banks, Bank erosion, Channel improvement, River beds, Bank protection, Erosion control, Silts, Sedimentation, Judicial decisions, Legal aspects, Cities, Ships.

Plaintiff city brought action against defendant oil company to recover the rental value of defendant's use of the city's bulkhead adjacent to defendant's riparian property. Defendant had erected two wharves and dredged a ship basin in front of its own and the city's property. Plaintiff contended that a state statute required riparian owners to pay for the use of city-owned bulkheads for the construction of wharves or other wharf purposes, and that, but for the bulkhead which prevented mud and silt from obstructing defendant's basin, the wharves would be useless. Plaintiff also alleged that maintaining the accessibility of the wharves was a 'wharf purpose'. Defendant offered to pay rent for the portion of the bulkhead actually used in constructing the two wharves but contended that no payment was due for the ship basin since it was not a wharf purpose. Affirming a judgment for plaintiff for the amount tendered by defendant, the court held that a ship basin was not a 'wharf, building in the nature of a wharf, or a structure for other wharf purposes'. Therefore, the statute did not require rent for the use of the bulkhead in connection with the basin. One justice dissented. (Liptak-Florida) W71-01630

DU PONT RAYON CO V RICHMOND INDUSTRIES, INC (RIPARIAN RIGHT TO USE WATER VERSUS PUBLIC RIGHT TO USE STREAM FOR SEWAGE).
85 F2d 981-984 (4th Cir 1936).

Descriptors: *Virginia, *Water pollution, *Riparian rights, *Sewage disposal, Navigable waters, Sewers, Tidal waters, Competing uses, Rivers, Stream pollution, Judicial decisions, Legal aspects, Damages, Outlets, Water utilization, Public rights, Saline water, Municipal wastes, Waste disposal, Cities, State jurisdiction, Water rights, Cities.

Riparian factory owner appealed from an order denying an interlocutory injunction and dismissing its complaint in a suit to enjoin defendant dyeing company from discharging wastes through municipal sewers into the river above plaintiff. Plaintiff alleged that its manufacturing needs required water free from dyestuffs and that defendant's proposed plant would pollute plaintiff's water supply. The Circuit Court of Appeals affirmed the lower court. While riparian owners in Virginia are entitled to make reasonable use of water as it flows past their lands, the right on tidal, navigable waters is subject to the right of the public to use waters for sewage disposal. The beds of such waters are owned by the state, and it is for the state to determine what uses are to be made thereof and how much pollution it will permit to be emptied into such waters. Even as to tidal streams there is liability for pollution resulting from negligent or unreasonable use of sewers. However, nothing in this case indicated such a situation. (Duss-Florida) W71-01631

CAROLINA POWER AND LIGHT CO V SOUTH CAROLINA PUBLIC SERV AUTH (LACK OF STANDING TO CHALLENGE STATE'S AUTHORITY TO CONSTRUCT POWER PROJECT).
94 F2d 520-526 (4th Cir 1938).

Descriptors: *South Carolina, *Administrative agencies, *Hydroelectric plants, *Navigation, Navigable waters, Hydroelectric power, Rivers, Streams, Hydroelectric project licensing, Projects, Obstruction to flow, Riparian rights, Diversion, Dams, Permits, Natural resources, Federal government, Channels, Legal aspects, Judicial decisions, Legislation, Public utilities, State governments, Adjudication procedure, Damages.

Plaintiff hydroelectric companies sought to enjoin the South Carolina Public Service Authority from constructing a power project and to enjoin the Federal Government from making a loan in aid of it. The project was designed to provide an improved water route and to generate electric power. To accomplish this, construction of a diversion dam would be necessary which would impair the navigability capacity of the stream. In the trial court plaintiffs attacked primarily the legality of the project from a legislative standpoint and the court ruled against them. The circuit court of appeals affirmed and found, moreover, that the plaintiffs had no standing to sue. They had no superior right to a license for the project, were not riparian owners that could be damaged, nor had any interest in navigation in the river. Their main damage would be that of competition, which in this case was lawful. Obstruction of the river was a matter for public authorities to decide and individuals could only complain if they suffered some direct or special injury. Plaintiffs presented no interest which was damaged. (Duss-Florida) W71-01632

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 88TH CONGRESS, 2ND SESSION.
Hearings—Subcomm on Conservation and Credit, Comm on Agriculture, US House of Reps, March 17, 18, June 11, 25, July 27, and Aug 19, 1964.

Descriptors: *Flood prevention, *Watershed management, *Watershed Protect. and Flood Prev. Act, *Legislation, Federal government, Mississippi River, Crop production, Crop response, Cultivated lands, Flooding, Floodwater, Floodways, Erosion, Gully erosion, Flood plains, Retention, Dams, Reservoirs, Municipal water.
Identifiers: *Congressional hearings.

Presented at these hearings before the Subcommittee on Conservation and Credit of the Committee on Agriculture of the House of Representatives, were plans for watershed projects in: Missouri, Iowa, Georgia, Arkansas, North Carolina, South Carolina, Texas, Vermont, New York, Delaware, Maryland, Indiana, Oklahoma, and Kentucky. The watershed projects were presented and defended by Representatives from the respective states. The main purpose for the proposal projects was flood prevention. Plans called for financing by the federal, state, and local governments. Federal assistance was sought as provided for in the Watershed Protection and Flood Prevention Act. (Price-Florida) W71-01633

HEARINGS ON WATERSHED PROJECTS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 2ND SESSION.

Hearings—Subcomm on Conservation and Credit—Watershed Projects—Comm on Agriculture, US House of Representatives, March 2, July 16, 17, 18, Sept 19, 25, 1962.

Descriptors: *United States, *Flood protection, *Water resources development, *Watersheds (Basins), River basin development, Legislation, Multiple-purpose projects, Project benefits, Project purposes, Project feasibility, Project planning, Programs, Dams, Damsites, Reservoirs, River basins, Public benefits, Social aspects, Condemnation value, Flood control, Conservation, Cost-benefit ratio, Watershed management, Water policy, Cost sharing.

The Subcommittee on Conservation and Credit of the Committee on Agriculture of the U.S. House of Representatives met on several occasions to hear testimony concerning various watershed projects. The projects were proposed for several locations and covered a wide range of features. Testimony was offered by chairmen of the projects, Congressional representatives of the locations in question, and other interested parties from the various areas. Of particular concern to the committee were: (1) cost-benefit ratios, (2) size of the affected areas, (3) population to be affected by the project, and (4) the relative costs to be assumed by the federal government and the governments of the individual project locations. The committee took the projects under advisement, and no decisions were reached concerning the individual proposals. (Barker-Florida) W71-01634

HEARINGS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT—WATERSHED PROJECTS, COMMITTEE ON AGRICULTURE, US HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.
Hearings on Watershed Projects—Subcomm on Conservation and Credit, Comm on Agriculture, US House of Representatives, July 21, 24, 25, Aug 15, 31, 1961.

Descriptors: *United States, *Flood protection, *Water resources development, *Watersheds (Basins), River basin development, Legislation, Multiple-purpose projects, Project benefits, Project purposes, Project feasibility, Project planning, Programs, Dams, Damsites, Reservoirs, River basins, Public benefits, Social aspects, Condemnation value, Flood control, Conservation, Cost-benefit ratio, Watershed management, Water policy, Cost sharing.

Field 06—WATER RESOURCES PLANNING

Group 6E—Water Law and Institutions

The Subcommittee on Conservation and Credit of the Committee on Agriculture of the U.S. House of Representatives met on several occasions to hear testimony concerning various watershed projects. The projects were proposed for several locations and covered a wide range of features. Testimony was offered by chairmen of the projects, Congressional representatives of the locations in question, and other interested parties from the various areas. Of particular concern to the committee were: (1) cost-benefit ratios, (2) size of the affected areas, (3) population to be affected by the project, and (4) the relative costs to be assumed by the federal government and the governments of the individual project locations. The committee took the projects under advisement, and no decisions were reached concerning the individual proposals. (Barker-Florida) W71-01635

HEARINGS AND REPORT ON DRAINAGE OF WETLANDS BEFORE THE SUBCOMMITTEE ON CONSERVATION AND CREDIT, COMMITTEE ON AGRICULTURE, UNITED STATES HOUSE OF REPRESENTATIVES, 87TH CONGRESS, 1ST SESSION.

Hearings and Report—Subcomm on Conservation and Credit—Drainage of Wetlands—Comm on Agriculture, US House of Reps, Aug 18, 1961.

Descriptors: *Drainage programs, *Wetlands, *Legislation, *Wildlife conservation, Conservation, Drainage, Land reclamation, Water policy, Federal government, Legal aspects, Surface waters, Marshes, Water conservation, Water resources development, Cultivation, Land resources, Preservation, Administrative agencies, Financing, Farms, Farm management.

A hearing before the Subcommittee on Conservation and Credit of the Committee on Agriculture was held to hear testimony concerning two bills to amend the Soil Conservation and Domestic Allotment Act. One bill prohibited the Secretary of Agriculture from assisting a farm operator in the drainage of wetlands when such drainage would inhibit wildlife preservation. A second bill authorized the Secretary of Interior to deny financial and technical assistance, for drainage programs administered by the Department of Agriculture, in cases of specifically identified drainage areas on farms where wildlife preservation would be materially affected by such drainage. Testimony was offered by various public officials and private individuals who were interested in the bills. The Committee of Agriculture report accompanying the second bill discussed the purpose of the bill, the Department of Agriculture's policy on drainage, and the provisions of the bill. (Powell-Florida) W71-01636

ECKART V CITY OF BELLEVILLE (CITY'S LIABILITY FOR WATER POLLUTION CAUSED BY DISCHARGE OF RAW SEWAGE INTO STREAM).

294 Ill App 144, 13 NE2d 641-644 (1938).

Descriptors: *Prescriptive rights, *Illinois, *Water pollution, *Municipal wastes, Compensation, Cities, Sewage sludge, Sewage, Sewage bacteria, Sewage effluents, Septic tanks, Sewage disposal, Streams, Riparian rights, Toxins, Pollutants, Fish-kill, Fouling, Odor, Oxygen sag, Worms, Legal aspects, Judicial decisions.

Identifiers: Nuisance (Public).

Plaintiff farmers sued to restrain defendant city from polluting a stream which flowed through plaintiffs' farms. Plaintiffs also sought to recover damages. Plaintiffs' evidence showed that defendant was discharging large quantities of raw, untreated sewage into the stream and that the stream was covered with soap scum and sludge, contained tubifex worms and fungus growth, and gave off vile odors. Plaintiffs contended that such a situation was a public nuisance. Defendant denied the pollution and contended that it had a prescriptive right to discharge sewage into the stream since it had

been doing so for over five years. Affirming a judgment for plaintiffs, the court held that a city could not pollute a natural watercourse without compensating those injured thereby, and that the maintenance of a continuing and increasing nuisance cannot give rise to a prescriptive right to continue the nuisance. (Liptak-Florida) W71-01637

BRADLEY V CITY OF MARLBORO (CITY'S LIABILITY FOR FLOODING CAUSED BY IMPROPERLY MAINTAINED CULVERT).

5 NE2d 439-442 (Mass 1936).

Descriptors: *Massachusetts, *Flood damage, *Culverts, *Compensation, Roads, Highways, Water injury, Rain water, Surface runoff, Overflow, Drains, Drainage water, Clay pipes, Storm drains, Surface drainage, Cities, Local governments, Judicial decisions, Legal aspects, Damages, Adjudication procedure, Jurisdiction.

Plaintiff landowners brought actions against defendant city to recover for damages caused by the negligent construction and maintenance of a culvert, which resulted in the flooding of plaintiffs' property during a rainstorm. Plaintiffs contended that the city superintendent of streets was acting as defendant's agent in constructing and maintaining the culvert and that defendant was liable for the superintendent's negligence. Defendant argued that the superintendent was acting as a public officer, a highway surveyor, and was not the city's agent. Reversing a judgment for plaintiffs, the court reviewed the applicable statutory provisions defining the authority of a superintendent of streets and concluded that the superintendent was a public officer rather than defendant's agent. Therefore, defendant could not be liable notwithstanding any showing of negligence or proximate cause. (Liptak-Florida) W71-01638

LYON V CITY OF BINGHAMTON (CITY'S LIABILITY FOR DIVERTING WATER AND FOR TAKING POSSESSION OF MILLDAM).

281 NY 238, 22 NE2d 354-358 (1939).

Descriptors: *New York, *Riparian rights, *Diversion, *Mildams, Dams, Backwater, Natural flow doctrine, Condemnation, Condemnation value, Adjudication procedure, Judicial decisions, Legal aspects, Streams, Cities, Local governments, Riparian owners, Riparian water, Prescriptive rights, Reservoirs, Municipal water, Streamflow, Relative rights.

Defendant city had diverted stream water from a dam and then had seized the dam to prevent plaintiff dam owner from lowering the water level to a point which would have interfered with defendant's diverted water supply. Plaintiff brought suit and contended that defendant was liable for damages for diverting water from plaintiff's mill pond prior to the seizure of the dam and that plaintiff was entitled to recover possession of the dam or its reasonable value. Defendant contended that it had the right to divert the water by virtue of a prior judgment against plaintiff's co-owner, and that it was not liable for diverting water in which it had riparian rights. The court held that plaintiff was not bound by a judgment in a suit against a co-owner to which plaintiff was not a party, but that plaintiff could not recover for water diverted from a flowing stream without showing actual damages since water is not subject to ownership until reduced to possession. Impounding water behind a dam does not constitute possession. However, defendant was held liable for the market value of the dam and appurtenances wrongfully appropriated. (Liptak-Florida) W71-01639

NEWKIRK V CITY OF TIPTON (SUIT FOR DAMAGES FOR REDUCTION IN LAND VALUE BECAUSE OF POLLUTION OF A STREAM).

136 SW2d 147-157 (Mo Ct App 1939).

Descriptors: *Missouri, *Water pollution, *Sewage effluents, *Property values, Damages, Cities, Treatment facilities, Sewage, Sewage disposal, Sewage treatment, Prescriptive rights, Depreciation, Water pollution sources, Water pollution effects, Legal aspects, Land tenure, Remedies, Riparian rights, Reasonable use, Condemnation value, Judicial decisions, Drainage, Prescriptive rights, Adjudication procedure.

Plaintiff sought damages for diminution in value of his land as a result of upstream discharge of sewage by the defendant city's new treatment plant into a stream running through plaintiff's property. Although the city denied that its plant had caused any new pollution of the stream, the plaintiff presented evidence of injury to farm animals from drinking stream water, of fishkill, and of other pollution effects beginning at approximately the same time as commencement of operation of the plant. The city claimed that plaintiff, as a lower riparian owner, had no cause of action against it, citing authority to the effect that such a landowner must submit without compensation to municipal discharge of sewage. The court, however, looked to the reasonable use doctrine and held that defendant had no right to injure any lower riparian owner in discharging sewage. Moreover, past discharges by individual riparian owners gave the city no prescriptive right to dump sewage. However, as the trial court had failed to require a specific finding by the jury that defendant's discharge had polluted the water and directly damaged plaintiff, the decision below for the plaintiff was reversed. (Caldwell-Florida) W71-01640

TALBERT V CITY OF WINCHESTER (FLOOD DAMAGE FROM DIVERTED SURFACE WATER).

277 Ky 164, 125 SW2d 1002-1005 (1939).

Descriptors: *Kentucky, *Culverts, *Flooding, *Diversion, Damages, Drainage, Flood damage, Alteration of flow, Ditches, Surface runoff, Diversion structures, Land tenure, Legal aspects, Judicial decisions, Cities, Drainage systems, Floods, Natural flow, Overflow, Adjudication procedure.

Plaintiff sought to enjoin defendant city from diverting surface waters onto his property. Plaintiff claimed that defendant had constructed a culvert which, in times of heavy rainfall, diverted water from a ditch onto his property and thereby flooded it. Defendant contended that the property was in a low place and that the conditions complained of were a result of natural drainage. There was conflicting evidence on whether the land's tendency to flood existed before the culvert was constructed. From a jury verdict for defendant, plaintiff appealed. The court held that plaintiff failed to show that any prejudicial error occurred at the trial, and affirmed the trial court's judgment for defendant. (Caldwell-Florida) W71-01641

CITY OF COVINGTON V MCKINNEY (OBSTRUCTION CAUSING OVERFLOW AS PERMANENT WHERE NOT REMEDIABLE AT REASONABLE EXPENSE).

263 Ky 131, 92 SW2d 1-4 (1936).

Descriptors: *Obstruction to flow, *Kentucky, *Surface runoff, *Ditches, Prescriptive rights, Judicial decisions, Legal aspects, Overland flow, Cities, Municipal water, Reservoirs, Drainage water, Rainfall, Rain water, Barriers, Diversion, Water conveyance, Damages, Structures, Adjudication procedure, Overflow, Flooding.

Identifiers: *Permanent, *Temporary.

Defendant city, which maintained reservoirs for supplying municipal water, constructed ditches to collect and drain surface water from the reservoir land. Following an overflow onto plaintiff's land during ordinary rains, plaintiff brought an action alleging that defendant's ditches were inadequate to carry the water collected therein and that defendant had permitted them to become obstructed. Defendant contended that the ditches had constituted permanent structures for over forty years; consequently, defendant claimed a prescriptive right to maintain ditches for the flow of rain water from defendant's land onto plaintiff's premises. Defendant also contended that damage caused by the permanent structures required a single recovery, which was barred by the statute of limitations. The Kentucky Court of Appeals, in affirming the lower court's decision for plaintiff, held that defendant had failed to prove that the obstruction causing the overflow was not remediable at a reasonable expense. Therefore, defendant had not established a permanent structure. Since the ditches were only temporary structures, the defendant had not acquired a prescriptive right. (Powell-Florida) W71-01642

THE ALBANIA (LIABILITY FOR DISCHARGE OF OIL IN HARBOR BY SHIP).

30 F2d 727-728 (SD NY 1928).

Descriptors: *New York, *River and Harbors Act, *Oil wastes, *Water pollution control Legal aspects, Judicial decisions, Remedies, Admiralty, Navigable waters, Federal government, Legislation, Harbors, Navigation, Ships, Pollutants, Water pollution, Water pollution effects, Water pollution sources, Regulation.

Libelant federal government sought to recover a penalty from respondent for discharging waste fuel oil into New York harbor. Respondent contended that the vessel did not violate the law, although one employee might have, and asserted that even if it was found to have violated the law, an 1888 act with a \$250 minimum penalty would apply rather than the Rivers and Harbors Act of 1899 which had a \$500 minimum penalty. The court found that the vessel's employee was acting in the service of the ship, whether instructed or not, and thus the ship violated the anti-discharge law. The court held the 1888 law would be applicable since it was specified in the Rivers and Harbors Act that the Act did not repeal or alter the provisions of the earlier act. The court further held although oil was not specifically listed in the 1888 act, oil was as dangerous to shipping as pollution with acid and came within the terms 'refuse' and 'other matter', the discharge of which was prohibited. (Morris-Florida) W71-01643

UNITED STATES V PENNSYLVANIA SALT MFG CO (RIGHT OF LANDOWNER ON NAVIGABLE WATERS TO MOOR VESSEL).

30 F2d 332-334 (3d Cir 1929).

Descriptors: *Pennsylvania, *Docks, *Bulkheads, *Riparian rights, Legislation, Judicial decisions, Remedies, Federal government, Contracts, Harbors, Piers, Navigable waters, Delaware River, Ships, Navigation, Navigable rivers, Bulkhead line, Riparian land, Legal aspects, Access routes.

Plaintiff federal government and its lessee sued to enjoin defendant manufacturing company from mooring vessels to plaintiff's bulkhead along a pier owned by defendant. Defendant claimed the right to moor both as an owner abutting navigable waters and by express reservation in a contract with plaintiff government. Plaintiff government, which owned an adjoining pier on the Delaware River in Philadelphia, had purchased a strip of defendant's pier and removed it to enlarge the slip between the two piers. The Court of Appeals, Third Circuit, in affirming a district court dismissal of plaintiff's request, held that the contract reserved the right of defendant to use the bulkhead built by the govern-

ment after removal of part of the pier. Further, the old slip was part of the navigable water of the river, and the enlarged slip also became navigable water. Every landowner on navigable water has the right to free access to such water and the right to moor vessels to a bulkhead on his own land. (Morris-Florida) W71-01644

F D GLEASON COAL CO V UNITED STATES (REGULATION OF DREDGING IN NAVIGABLE WATERS).

30 F2d 22-25 (6th Cir 1929).

Descriptors: *Michigan, *River and Harbors Act, *Dredging, *Navigable rivers, Legal aspects, Judicial decisions, Remedies, Federal government, Legislation, Navigable waters, Navigation, Channels, Excavation, Inland waterways, Maps, Buys, Regulation.

Plaintiff federal government charged defendant coal company with unauthorized dredging in a navigable river in violation of the Rivers and Harbors Act of 1899. Defendant contended that only dredging which altered the course of a channel was prohibited, that regulating such an innocuous act was not within the federal commerce power and that certain evidence showing its dredge to be on the American rather than the Canadian side of the channel should not have been admitted. The court, in affirming defendant's conviction, held that the Act should be construed to prohibit dredging or altering the course of navigable waters. The court stated that the fact that one act such as defendant's might not interfere with navigation did not mean Congress could not deal with such acts as a class when the overall effect could be harmful. The court also held that the evidence which showed the dredging to be on the American side of the channel was admissible. (Morris-Florida) W71-01645

PETITION OF HIGHLANDS NAVIGATION CORP (LIMITATION OF LIABILITY FOR ABANDONING SUNKEN SHIP).

29 F2d 37-39 (2d Cir 1928).

Descriptors: *New York, *Rivers and Harbors Act, *Harbors, *Disasters, Legal aspects, Judicial decisions, Remedies, Damages, Legislation, Local governments, Piers, Docks, Navigable waters, Ships, Boats, Burning, Navigation, Channels, Cities, Admiralty, Costs, Cost repayment.

Petitioner filed for a limitation of liability after his two ships burned and sank in navigable waters off the piers of New York City. Petitioner abandoned the two vessels which were total losses. The city opposed the limitation, claiming a city ordinance required the owner of a sunken vessel to remove it and, if he did not, allowed the city to remove it and charge the cost to the vessel's owner. The Circuit Court of Appeals, Second Circuit, in affirming a district court order granting the limitation, held that the Rivers and Harbors Act of 1899 recognized the right of abandonment and was intended to preserve that right of maritime law. After giving proper notice to the Secretary of War, the owner of an abandoned vessel is not liable for damage caused by other vessels striking the abandoned vessel and is not liable for the cost of raising such vessel. The court held that since Congress granted such exemption, a city ordinance could not remove it. (Morris-Florida) W71-01646

HIGGINS LUMBER AND EXPORT CO V DRACKETT (INTERPRETATION OF LEASE OF WHARF).

125 So 322-324 (La 1929).

Descriptors: *Louisiana, *Leases, *Docks, *Harbors, Boats, Ships, Legal aspects, Judicial decisions, Local governments, Damages, Piers, Port authorities, Navigable waters, Rent, Contracts, Repairing.

Plaintiff, lessee of a wharf, sued defendant steamboat owner for services rendered, labor and material. Defendant contended the charge for rent of the use of plaintiff's wharf was illegal under plaintiff's lease with the Board of Commissioners of the Port of New Orleans since such lease prohibited subletting of wharfage. Defendant also claimed that plaintiff had agreed not to charge him for mooring his boat and barges. Plaintiff had repaired defendant's steamboat, but defendant had remained moored 54 more days to make additional repairs. The court, in affirming the trial court's judgment for plaintiff, held there was no subletting of the wharfage, but merely an agreement to allow defendant to use plaintiff's pilings and the facilities and equipment of its plant. Another clause in the lease requiring fees to be paid to the Board except when a vessel was in the harbor on business of plaintiff did not apply since defendant's boat was there originally to allow the plaintiff to repair it and remained there to use plaintiff's facilities. (Morris-Florida) W71-01647

DEERING V MARTIN (SALE AND USE OF SOVEREIGNTY LANDS).

116 So 54-66 (Fla 1928).

Descriptors: *Florida, *Public rights, *Shoals, *Ownership of beds, Legal aspects, Judicial decisions, Remedies, State governments, Legislation, Islands, Public lands, Navigable waters, Beds, Sand bars, Beach erosion, Coastline, Ocean currents, Tidal waters, Water level fluctuations, Navigation, Atlantic Ocean, Boundaries (Property), Riparian rights, Administrative agencies, Relative rights.

Plaintiffs owned Key Biscayne's southernmost section and sued to enjoin defendant Trustees of the Internal Improvement Fund of Florida from selling submerged lands south and west of Key Biscayne to codefendant Henderson. Defendant Henderson, who planned to bulkhead the submerged shoals and fill them in to create a series of islands, and the trustees demurred. The Supreme Court of Florida, in reversing the upholding of the demurrer, held that the lands were sovereignty lands under navigable waters and as such were subject to the public trust doctrine. The trustees could grant limited privileges for use of the land, but could not impair the rights of the people, even under a statute authorizing sale of such lands. Since plaintiffs would suffer particular injury if the land were illegally sold, they could properly seek relief from public nuisance. The court also found that the deed to defendant Henderson was too vague since it described the land granted as that where the water cover was less than three feet at high tide and that the complaint raised the question of whether any of the land was within that description. (Morris-Florida) W71-01648

DAVIS V IVEY (LIABILITY FOR ALTERING FLOW OF SURFACE DRAINAGE).

112 So 264-273 (Fla 1927).

Descriptors: *Florida, *Alteration of flow, *Surface drainage, *Natural flow doctrine, Railroads, Flooding, Rainfall intensity, Damages, Roadbanks, Ditches, Embankments, Impounded waters, Obstruction to flow, Diversion, Diversion structures, Drainage, Surface waters, Cultivated lands, Judicial decisions, Legal aspects, Agriculture, Natural flow, Weather forecasting, Surface runoff.

Plaintiff landowner brought action to recover for losses allegedly resulting from defendant railroad's construction of a roadbed which obstructed the natural drainage of land adjacent to plaintiff's and caused water to back up onto plaintiff's property. Defendant contended that the flooding complained of was due to an act of God. The court ruled that failure to guard against an act of God that could have been guarded against was actionable negligence, and that a party changing the flow of water must provide against more than ordinary rainfall if such rainfall occurs occasionally, even

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though at irregular intervals. The court found that the evidence was sufficient to sustain the lower court's judgment for plaintiff. (Price-Florida) W71-01649

C A SCHNACK JEWELRY CO V O'SHEE REALTY CO (LIABILITY FOR INADEQUATE DRAINAGE OF RAIN WATER).
162 La 815, 111 So 174-177 (1927).

Descriptors: *Louisiana, *Seepage, *Drainage practices, *Water injury, Surface runoff, Damages, Drainage, Drainage water, Rain water, Leases, Prescriptive rights, Surface waters, Runoff, Water-proofing, Roofs, Drainage effects, Rainfall-runoff relationships, Judicial decisions, Legal aspects, Adjudication procedure.

Plaintiff sought damages for injury to his building allegedly caused by water that accumulated on the roof of defendant's adjoining building as a result of defendant's failure to provide adequate drainage for rainwater. Defendant denied that the injury accruing to plaintiff was caused by his drainage practices. The court stated that plaintiff had the burden of proving the proximate cause of its injury, and held that plaintiff had failed to meet this burden. Since the evidence supported the lower court's finding for defendant, the judgment was affirmed. (Price-Florida) W71-01650

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION, TARRANT AND JOHNSON COUNTIES, TEXAS.
Corps of Engineers, Fort Worth, Tex.
For primary bibliographic entry see Field 04A.
W71-01329

6G. Ecological Impact of Water Development

SCIENCE AND TECHNOLOGY AND ITS APPLICATION TO THE PROBLEMS OF POLLUTION, TRANSPORTATION AND EMPLOYMENT. PUBLIC SCIENCE POLICY: BACKGROUND READINGS.
Federation of Rocky Mountain States, Inc., Denver, Colo.
Donald W. Galvin, and Nick Jannakos.
Available from NTIS as PB-190 500, \$3.00 in paper copy, \$0.95 in microfiche. Western State Conference, March 9-11, 1970, Salt Lake City. Various pagings.
Identifiers: *Air pollution, Management planning, *Management planning, Employment, *Water pollution, *Transportation, Economics, Organizations, United States government, Sociometrics, Urban areas, Rural areas, Population, Natural resources, Rocky Mountain states, State government, Local government, Technological development.

The document covers what government leaders and the science and technology community must do to set up the mechanism and lines of communication required to bring technology to bear on current public problems. It identifies potential applications of new technology to social problems in the areas of pollution, transportation, employment and future planning. It contains recommendations for federal, regional, interstate, state and local action in order to fully utilize science and technological resources, overcoming problems in federal-state relations, inter-agency relations, communications, financing, and manpower.
W71-01118

BIOLOGICAL EFFECTS OF EFFLUENT FROM A DESALINATION PLANT AT KEY WEST, FLORIDA.
Westinghouse Ocean Research Lab., San Diego, Calif.

For primary bibliographic entry see Field 05C.
W71-01266

THE CONVERGENCE OF ENVIRONMENTAL DISRUPTION.
Marshall I. Goldman.
Science, Vol 170, p 37-42, Oct. 2, 1970. 13 ref.

Descriptors: *Environment, *Environmental effects, *Social aspects, *Institutions, *Decision making, Aquatic environment, Conservation, Governments, Natural resources.
Identifiers: *Russia, Socialist governments.

Environmental disruption is as severe in Soviet Russia as it is in the United States. Although it has been often assumed that publicly owned factories could take into account social costs as well as private costs, state ownership of the country's productive resources may actually exacerbate the situation in some ways. In the largest Soviet republic, the RSFSR, only 35% of factories and 40% of cities and suburbs have treatment plants. The developments around Lake Baikal are already causing ecological damage. Air pollution and land erosion are largely uncontrolled. The Soviets, no more than we, have been able to establish social costs of environmental pollution. Although the Soviets do have certain advantages such as the power to avoid wasteful production, state officials are usually judged on basis of the contribution to the nation's economic development, and pollution control is regarded as non-productive. (Whipple-Rutgers) W71-01347

MAN AND HIS ENVIRONMENT.
G. Ansley Coale.
Science Vol. 170, p 132-136, Oct. 9, 1970.

Descriptors: *Environment, Environmental effects, *Social aspects, *Population, Institutions, Fecundity, Natural resources.
Identifiers: *Externalities, *Population control.

Economic factors are more important than population growth in threatening the quality of American life. Economists say that environmental pollution occurs through disregard of externalities. It is desirable to internalize externalities. We are using up the world's raw materials quite fast, but the purchases of raw materials from undeveloped countries have economic advantage to them. Population growth in the United States is discussed, and it is concluded that a rapid leveling off of our population growth is almost impossible but that a relatively moderate reduction in fertility would level population off with an increase of 35 or 40 per cent. As regards pollution, per capita increase in production has been more important than population growth. Various policies may be adopted to decrease adverse environmental effects, including particularly the limitation of population. (Whipple-Rutgers) W71-01348

RESTORATION OF LOST AND DEGRADED HABITATS.
Smithsonian Institution, Washington, D.C.
Raymond F. Fosberg.
In: Future Environments of North America, ed. Darling, F. Fraser and Milton, John P., (The Natural History Press: Garden City, New York, 1966), p 502-515.

Descriptors: *Environmental effects, *Ecology, *Agricultural, Watersheds, *Lumbering, *Urbanization, *Industrial plants, *Flood damage, *Dredging, *Pollutants, Recreation demand, Aesthetics, Economic efficiency, Organic matter.
Identifiers: *National park system, *Elimination of species, *Erosion control, *Dessication.

Means of restoring destroyed and degraded areas to something approaching natural conditions are examined. Six biological consequences of habitat degradation are listed ranging from changes in the

composition and structure of vegetation and biotic communities to creation of biological vacua. Causes of degradation discussed include: logging, agriculture, urbanization and industrialization, flooding, dredging and filling in shallow water, exploitation of material of the substratum, and habitat degradation by pollution. The author contends that overcrowding will make restoration necessary; as the pressure on land increases, areas that are totally degraded and not being actively used are likely to be in demand for recreational uses of various sorts. Current attempts at restoration include efforts to rehabilitate overgrazed rangelands, retiring marginal agricultural land to establish hunting preserves and attempts by the National Park System to recreate in parks the ecological scene as viewed by the first Europeans. Eight major principles and approaches are discussed: (1) defining present ecological nature of the degraded habitat, (2) defining proposed ecological habitat, (3) using natural succession if no time pressure exists, (4) selectively eliminating species under certain conditions, (5) building up significant organic matter to raw subsoil by planting species, (6) checking advanced erosions with plants or engineering, (7) short-cutting of succession under certain conditions, (8) protecting plants from undue dessication. A major problem is foreseen in determining when a complete functional community has been established. (Preckwinkle-Chicago) W71-01367

WATER LAW'S DOUBLE ENVIRONMENT: HOW WATER LAW DOCTRINES IMPEDE THE ATTAINMENT OF ENVIRONMENTAL ENHANCEMENT GOALS.
For primary bibliographic entry see Field 06E.
W71-01547

07. RESOURCES DATA

7A. Network Design

DESIGN OF WATER QUALITY SURVEILLANCE SYSTEMS - PHASE I - SYSTEMS ANALYSIS FRAMEWORK.
NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.
For primary bibliographic entry see Field 05A.
W71-01264

IBP DESERT RESEARCH UNDERWAY.
For primary bibliographic entry see Field 06A.
W71-01284

7B. Data Acquisition

RADIOMETRIC DETECTION OF OIL SLICKS.
Aerojet-General Corp., El Monte, Calif.
For primary bibliographic entry see Field 05A.
W71-01144

REMOTE SENSING OF COASTAL WATERS USING MULTISPECTRAL PHOTOGRAPHIC TECHNIQUES.
Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
Edward Yost, and Sondra Wenderoth.
Available from NTIS as AD-705 116, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report SERG-TR-10, January 1970, 210 p. ONR Contract N00014-67-C-0281.
Identifiers: *Ocean surveillance, Multiband spectral reconnaissance, *Target recognition, Underwater, Sensors, Photographic techniques, Optical properties, Penetration, Band spectrum, Photographic emissions, Brightness, Color photography, Mexico Gulf, Remote sensing.

An evaluation of multispectral photographic techniques for optical penetration of water in Northwestern United States and Gulf of Mexico coastal waters showed the green spectral band to

maximize the detectability of underwater targets. This type of particulate matter in suspension in the water as well as the size and quantity of the particles significantly affects the ability to optically penetrate water. In general, the spectral band (493-543nm) when exposed to place the water mass at about unity density on the photographic emulsion, was found to give the best water penetration independent of altitude or time of day as long as solar glitter from the surface of the water was avoided. When optimally exposed, the images of surface and underwater objects showed greater chromatic enhancement in multispectral color renditions than on conventional Aerial Ektachrome color films. Multispectral negative color renditions were found to be equally as good as positive color images for achieving color differences between the water mass and submerged objects. An isoluminous color technique has been perfected. This photographic process eliminates the dimension of brightness from a multispectral color presentation. By this method, objects exhibiting subtle spectral differences which are normally obscured by the comparatively large brightness present in coastal waters can be detected.

W71-01162

SMALL CONCRETE SPECIMENS UNDER REPEATED COMPRESSIVE LOADS BY PULSE VELOCITY TECHNIQUE,

N. K. Raju.

Journal of Materials, Vol 5, No 2, p 262-272, June 1970. 11 p, 9 fig, 14 ref.

Descriptors: Concrete technology, *Test specimens, Stress-strain curves, Failure (Mechanics), Concretes, Fatigue (Mechanics), *Non-destructive tests, Static tests, *Concrete testing, *Compressive strength, Concrete control, Cracks.

Identifiers: Ultrasonic impulse method, Ultrasonic tests, *Pulse velocity tests, *Microcracks, High strength concretes.

Tests conducted on prismatic concrete specimens have revealed significant differences in the magnitude of pulse velocity decrease under static and repeated load systems. The ultrasonic pulse velocity technique was used to study microcracks formed in high-strength concrete in a state of uniaxial compression under static and repeated loads. The progressive nature of the failure in concrete under repeated loads was studied by the parameter percentage decrease in pulse velocity in relation to the percentage of fatigue life. An empirical relation between the parameters, established from test data, could be used to predict the remaining fatigue life of a partially fatigued specimen. The magnitude of decrease in the pulse velocity in the lateral direction under repeated compressive loads is nearly 3 times greater than that under static loads. (USBR)

W71-01310

FLOW METERS FOR WATER RESOURCE MANAGEMENT,

Agricultural Research Service, Phoenix, Ariz.

J. A. Replogle.

Water Resources Bulletin, Vol 6, No 3, p 345-374, May-June 1970. 30 p, 9 fig, 1 tab, 132 ref.

Descriptors: *Flow measurement, Fluid flow, *Flowmeters, History, Measuring instruments, Rotating meters, Volumetric meters, Metering, Water resources, Bibliographies, Weirs, Sharp crested weirs, Reviews, Rectangular weirs, Cipolletti weirs, Parshall flumes.

Identifiers: *Water resources management, Accuracy.

Regulated waterflow is an essential feature of modern civilization. Effective use of water resources by industrial, agricultural, and municipal processes, and as domestic conveniences requires controlled-flow systems. Closely related to this regulation is the requirement for flow measurement, the techniques of which have developed over

many centuries. Because of the relatively long history of flowmetering and the multitude of improvements and new developments, a complete coverage of the subject is not possible. In this paper greater emphasis is placed on describing new developments and less conventional methods that are most usable for water resource applications and research studies, and less emphasis on older, generally familiar devices. Because of the diverse requirements in water measurement, few devices can be regarded as having no possible application. Selecting the most usable devices is somewhat arbitrary, but passing mention is made of most known devices for all fluids; reference material for more complete coverage of a particular device or system is included. Has 132 references. (USBR)

W71-01316

FLOW GRAPH MODELS OF THERMAL PROCESSES,

Windsor Univ. (Ontario).

W. K. Roots, and E. Tulunay.

Chemical and Process Engineering, - Heat Transfer Survey, 1970, p. 49-52.

Descriptors: *Heat transfer, Heat budget, Temperature, Heat balance, Heat flow, Heat Exchangers, Temperature control.

Identifiers: Graphical models, Flow graph models.

A method for modelling thermal processes by flow graph techniques has been developed. It facilitates analysis of final temperature states and related phenomena within the process. The method is generally applicable to analysis and design procedures for all thermal processes, although the article describes its application to fluidized-bed processes. In the diagrams all final temperature levels and materials involved are represented by geometric figures and branches between them. The rules for the construction and use of flow diagrams are derived and presented. The above analysis is advantageous for complete heat transfer processes that involve more than two materials. (Novotny-Vanderbilt)

W71-01343

PRIMARY PRODUCTION AS A FUNCTION OF THE STRUCTURE OF PHYTOPLANKTONIC ASSOCIATION (IN RUSSIAN),

Moscow State Univ. (USSR).

V. D. Fedorov.

Doklady Akademii nauk SSSR, Vol 192, No 4, p 901-904, 1970. 1 fig, 1 tab, 5 ref.

Descriptors: *Mathematical studies, *Phytoplankton, *Ecosystems, *Physiological ecology, Primary productivity, Marine microorganisms, Correlation analysis, Statistical methods.

Identifiers: White Sea, Karelian shores, Fisher index, Margalef index.

The physiological activity of an ecosystem was expressed as a function of the density of a species, the calculated maximum density of the same, and the total number of species in a given community. A statistically significant correlation between this function and the total or specific production of biomass permits estimates of the primary production entirely on the basis of phytoplanktonic samples. The estimates have been narrowed down through an introduction of a coefficient for the structural diversity of the association (D/Dmax). (Wilde-Wisconsin)

W71-01473

QUANTITATIVE SAMPLING WITH THREE BENTHIC DREDGES,

Bureau of Sport Fisheries and Wildlife, Yankton, S. Dak. North Central Reservoir Investigations.

For primary bibliographic entry see Field 05C.

W71-01477

AN IMPLEMENT FOR TAKING LARGE UNDISTURBED CORE SAMPLES FROM LAKE SEDIMENTS (IN GERMAN), Eidgenossische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland). For primary bibliographic entry see Field 02H.

W71-01494

DETERMINATION OF ASSIMILABILITY OF ALGAE, YEASTS, AND BACTERIA BY CERTAIN REPRESENTATIVES OF CLADOCERA (IN RUSSIAN),

For primary bibliographic entry see Field 02H.

W71-01496

ACOUSTIC TECHNIQUES OF FISH POPULATION ESTIMATION WITH SPECIAL REFERENCE TO ECHO INTEGRATION,

Washington Univ., Seattle. Fisheries Research Inst.

For primary bibliographic entry see Field 02H.

W71-01508

MICROBIAL CONTAMINATION IN SPACECRAFT WATER SYSTEM.

Aircraft Porous Media, Inc., Glen Cove, N.Y.

For primary bibliographic entry see Field 05B.

W71-01516

WATER CONTENT MEASUREMENT BY NEUTRON ATTENUATION FOR APPLICATION TO STUDY OF UNSATURATED FLOW OF SOIL WATER,

Washington State Univ., Pullman. Dept. of Agronomy.

For primary bibliographic entry see Field 02G.

W71-01524

SPECTRAL SURVEY OF IRRIGATED REGIONAL CROPS AND SOILS ANNUAL REPORT, 1 OCT. 1968-30 SEP. 1969.

Agricultural Research Service, Weslaco, Tex.

Available from NTIS as N70-17517, \$3.00 in paper copy, \$0.95 in microfiche. September 30, 1969, various pagings. NASA-CR-107881, NASA ORDER R-09-038-002.

Identifiers: *Aerial photography, *Farm crops, *Infrared photography, *Soils, Agriculture, Diseases, Spectrophotometers.

Research reports on remote sensing investigations are presented. Applications include color recombinations imagery for soils and plants; reflectance of single leaves and plots of cotton, and detection of cellular discoloration in cotton; and the detection of insect damage and foot rot disease of citrus trees with infrared film. Reflectance produced by vegetation on a soil background was studied by isotropic light interacting with a compact plant leaf plant irradiance specified by Duntley equations, and incident and reflected short wavelength radiation. The relationship between near infrared reflectance and cotton maturity is described. Aerial film types, photointerpretation, and mapper imagery are also discussed. Details are given on the discrimination of vegetation by multispectral reflectance, the discrimination on infrared film of crop species and soil conditions, and 9-channel scanner data. The procurement of a field spectrometer and random errors associated with a spectrophotometer are mentioned. Trips to Brazil and Mexico by the agriculture representative to NASA's International Participation Program are also reported.

W71-01539

7C. Evaluation, Processing and Publication

ANNOTATED LIST OF PUBLICATIONS, 1895-1970,

Illinois State Water Survey, Urbana.

Field 07—RESOURCES DATA

Group 7C—Evaluation, Processing and Publication

For primary bibliographic entry see Field 10.
W71-01105

A VARIABLE-BOUNDARY NUMERICAL TIDAL MODEL,
Alaska Univ., College. Inst. of Marine Science.
For primary bibliographic entry see Field 02L.
W71-01167

THE USE OF LINEAR PROGRAMMING FOR ESTIMATING GEOHYDROLOGICAL PARAMETERS OF GROUNDWATER BASINS,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
For primary bibliographic entry see Field 02F.
W71-01193

USING EXPERIMENTAL MODELS TO GUIDE DATA GATHERING,
General Electric Co., Santa Barbara, Calif. Center for Advanced Studies.
For primary bibliographic entry see Field 02F.
W71-01194

EARTH RESOURCES RESEARCH DATA FACILITY INDEX.
National Aeronautics and Space Administration, Houston, Tex. Manned Spacecraft Center.

National Aeronautics and Space Administration
Manned Spacecraft Center Report MSC-02576,
July 1970.

Descriptors: *Bibliographies, *Hydrologic data, Maps, *Research facilities, Remote sensing, Data collections, Oceanography, Data Processing, Data storage and retrieval, Maps.
Identifiers: Lists, Reports available, National Aeronautics and Space Administration.

Hydrologic information and data that are available at the National Aeronautics and Space Administration's Manned Spacecraft Center are listed in this index as a part of Earth Resources Program information. Items in the hydrology section are listed under the following subtitles: Site maps; Site Descriptions; Mission Screening and Summary Reports; Technical Letter Reports; Summary Reports; Subject Related Documents; and Technical Reports. Also included is a section on oceanography. (Woodard-USGS)
W71-01206

LIST OF INTERNATIONAL HYDROLOGICAL DECADE STATIONS OF THE WORLD.
For primary bibliographic entry see Field 02A.
W71-01208

COMPUTER SIMULATION OF RIVERBED DEGRADATION AND AGGRADATION BY THE METHOD OF CHARACTERISTICS,
South Dakota State Univ., Brookings.
For primary bibliographic entry see Field 02E.
W71-01212

SIMULATION FOR THE EFFECTIVE DISTRIBUTION OF WATER RESOURCES,
Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 06A.
W71-01219

THE EXPANFION OF THE SCOPE AND ROLE OF HYDRO--A PROBLEM-ORIENTED COMPUTER LANGUAGE FOR WATER RESOURCES,
Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Civil Engineering; and General Analytics, Pittsburgh, Pa.
George Bugliarello, John T. Onstott, and and Lawrence A. Jostes.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 1-8, 1969. 8 p, 3 fig, 9 ref.

Descriptors: *Computer programs, *Hydraulics, *Water resources development, *Programming languages, Computers, Digital computers, Planning, Model studies, Data processing, Water quality, Water yield, Groundwater movement, Hydrology.
Identifiers: Computer language (Hydro).

Study of the need for a problem-oriented language for hydraulic engineering led to the development of the language HYDRO. From being initially intended as a language for simplifying the approach to the computer by the engineer, HYDRO has evolved toward the solution of the command and control problem in water resources systems. This paper surveys current developments in HYDRO in this direction, including extension to the area of water quality, and discusses the underlying philosophy. (Knapp-USGS)
W71-01222

MATHEMATICAL MODELLING ON DIGITAL COMPUTERS AND CALCULATIONS FOR MULTI-PURPOSE UTILIZATION OF STREAM-FLOW,
For primary bibliographic entry see Field 06A.
W71-01228

FLOOD FORECAST AND FLOOD CONTROL BY COMPUTER,
Ministry of Construction, Morioka (Japan).
For primary bibliographic entry see Field 04A.
W71-01229

THE ANALYSIS OF UNSTEADY FLOW IN RIVERS BY AN ANALOGUE COMPUTER,
Public Works Research Inst. Tokyo (Japan). Akihiko Tsuchiya, Kunimatsu Hoshihata, and Akira Takahashi.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 439-446, 1969. 8 p, 6 fig, 1 tab.

Descriptors: *Flood forecasting, *Analog computers, Routing, Flood routing, Stage-discharge relations, Unsteady flow, Model studies, Analog models, Hydraulic models.
Identifiers: Chikugo River (Japan).

Analog computers in which hydraulic variables are transformed to electric potential or current were developed to find the magnitude of each term in the equation of motion of unsteady flow in rivers. Reliability of the computer was verified by experimental flood propagation in an experimental flume. Chikugo River, Japan, was simulated in the computer and the flood protection project of the river was evaluated for various conditions. (Knapp-USGS)
W71-01230

A COMPUTER SIMULATION STUDY OF TRAVELTIMES OF INJECTED PARTICLES AND TIDE-WAVES IN WELL-MIXED ESTUARIES,
Geological Survey, Washington, D.C. Water Resources Div.
For primary bibliographic entry see Field 02L.
W71-01252

ANALOG COMPUTERS FOR FOREST HYDROLOGY RESEARCH,
Washington Univ., Seattle. Inst. of Forest Products. David W. Wooldridge, and John D. Fox, Jr.

Available from NTIS as PB-195 783, \$3.00 in paper copy, \$0.95 in microfiche. Completion Report, Washington Water Research Center, Washington State Univ. Pullman, Sept 1970. 39 p, 16 fig, 32 ref, append. OWRR A-037-Wash (1).

Descriptors: *Water balance, Hydrology, *Soil-plant-atmosphere, *Computer simulation, *Forestry.

This project concentrated on (1) describing mathematically soil-plant-atmosphere systems in terms of water balance and continuity of mass equations and (2) working with analog computer theory and programming techniques for modeling above relations. This investigation suggests many possible applications in forest hydrology as well as applied and basic hydrology. General principles and methods of analog computer simulation are discussed. Examples of hydrologic models are presented, including surface flood runoff, a model for vertical transport processes from the forest cover to the soil system and a program for modeling one-dimensional soil-water flow with time. These models illustrate the capability and potential of analog simulation in forest hydrology. Verification was not attempted due to insufficient input data and the difficulty of converting discrete digital input data into analog input signals. Limitations and advantages of digital and analog simulations are discussed. (Wooldridge-Wash)
W71-01411

08. ENGINEERING WORKS

8A. Structures

CONSTRUCTION STRESSES IN DWORSHAK DAM,
California Univ., Berkeley. Structural Engineering Lab.
Jerome M. Raphael, and Ray W. Clough.
Available from NTIS as AD-701 895, \$3.00 in paper copy, \$0.95 in microfiche. Final report, April 1965, 78 p. Report No. 65-3. Contract DA-45-164-CIVENG-63-263.
Identifiers: *Dams, Stresses, Foundations (Structures), Reinforced concrete, Loading (Mechanics), Creep, Elasticity, Thermal stresses, Cracks, Mathematical models, Washington (State), Computer analysis, Computerized simulation, Finite element analysis, Dworshak Dam (Washington state).

Because of the successful use of the finite element analysis procedure in determining the distribution of stresses in the cracked section of Norfolk Dam, an investigation was made to see if it would be feasible to make a finite element analysis of the stresses in Dworshak Dam, taking into account the actual construction program for the dam, the individual temperature histories of each lift of concrete, and the time dependent elastic and creep properties of the concrete.
W71-01117

FAILURE STUDY OF AN OVERLOADED 96 IN. CONCRETE PIPE,
California State Div. of Highways. Materials and Research Dept.
Travis Smith, Earl C. Shirley, Robert E. Smith, and Dale W. Sathre.
Available from NTIS as PB-190 762, \$3.00 in paper copy, \$0.95 in microfiche. Final Report, February 1970. 33 p, append.
Identifiers: *Pipes, Concrete, *Underground structures, Loading (Mechanics), *Sanitary engineering, Pipes, Sewage, Soils, Compressive properties, California.

A three-year old 96-inch sewer in San Diego, designed for approximately 13 feet of cover, was abandoned because of overload from the construction of a new 40- 50-ft highway embankment. The portion of the pipe affected by the surcharge was studied through failure. The pipe failed as expected

and behaved thereafter as a flexible conduit. There was a marked variance in the relative distortion of the pipe at different locations; apparently because of differences in the bedding and compressibility of the layer of soil surrounding the pipe. It was concluded that a pipe located in compressible soil (either natural ground or embankment) and subjected to surcharge, can be overloaded because of the generation of passive earth pressures.
W71-01120

EROSION AND RIPRAP REQUIREMENTS AT CULVERT AND STORM-DRAIN OUTLETS,
Army Engineer Waterways Experiment Station, Vicksburg, Miss.
Joseph P. Bohan.
Available from NTIS as AD-702 247, \$3.00 in paper copy, \$0.95 in microfiche. January 1970. 18 p, tabs. Research Report H-70-2.
Identifiers: *Structures, Drainage, *Soils, Erosion, Pipes, Construction materials, Gravel, Stabilization, Terrain, Storms, Drainage, *Culverts, Riprap, Storm sewers, Embankments.

Investigations were conducted in experimental facilities to determine the characteristic of scour below a culvert outlet discharging onto a horizontal blanket of cohesionless soil and to develop guidance for designing riprap protection downstream of culvert and storm-drain outlets. Scour holes, produced by the discharge of various flows of several durations through culverts of various shapes and sizes, were observed and contoured. These data were obtained for several tailwater conditions and were used to develop generalized expressions describing the maximum length, width, depth, and volume of scour as functions of the flow duration and the Froude number of flow at the culvert outlet. Dimensionless scour profiles and cross sections, for low and high tailwater conditions, were also developed. Riprap blankets of various configurations and stone sizes were tested with several culvert sizes and shapes and various tailwater conditions to determine when displacement or failure occurred. The results were used to develop generalized relations to describe the stone size and appropriate blanket configuration required to prevent blanket failure and soil erosion, respectively, at a culvert or storm-drain outfall.
W71-01126

HYDRAULIC MODEL STUDIES OF AN ENERGY DISSIPATOR FOR A FIXED CONE VALVE AT THE UTE DAM OUTLET WORKS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
G. L. Beichley.
Available from NTIS as PB-192 709, \$3.00 in paper copy, \$0.95 in microfiche. March 1970. 3 p, tabs. REC-OCE-70-11.
Identifiers: *Dams, Valves, *Valves, Performance (Engineering), Liquid jets, Control systems, Hydraulic models, Baffles, Modification kits, Conical bodies, Hydrodynamics, *Outlet works, *Energy dissipators, Stilling basins, Ute Dam.

Laboratory studies were made with a 1:8 scale model of Ute Dam outlet works to aid in the development of a basin-type energy dissipator. The existing outlet works is to be modified by installing a horizontal cylinder (fixed-cone) valve structure for controlling the discharge into a concrete outlet channel. Hydraulic model tests of the energy dissipator for the valve discharge revealed problems caused by submergence of the control valve, surging in the energy dissipator, and overtopping in the outlet channel. The preliminary design was modified to reduce submergence and to stabilize the flow in the energy dissipator and outlet channel.
W71-01142

PERE MARQUETTE RY V SIEGLE (LIABILITY FOR INTERFERENCE WITH ICE BUSINESS BY DAM OPERATION).
For primary bibliographic entry see Field 06E.
W71-01150

ANALYSIS AND MODEL TESTS TO DETERMINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM,
Hydronautics Inc., Laurel, Md.
For primary bibliographic entry see Field 05G.
W71-01172

ALPE GERA DAM,
G. Gentile.
Paper Engineering Foundation Research Conference Rapid Construction Concrete Dams (Asilomar, Calif, Mar 1970) Engineering Foundation, New York City. 21 p, 13 fig, 4 tab.

Descriptors: *Gravity dams, *Concrete dams, Concrete placing, Costs, Foreign construction, *Foreign design practices, Aggregates, Stress, Construction equipment, Concrete testing, Quality control, Frost action, Temperature, Construction joints, Contraction joints, Concrete control, Construction, Dams, Mass concrete.
Identifiers: Italy, Cement content, *Construction methods, Alpe Gera Dam, Italy.

The Alpe Gera Dam, located at an elevation of 2215 m above sea level, is a massive concrete gravity dam built in the middle of the Italian Alps during 1961-64, and is an example of rapid construction of concrete dams. To keep the cost down in such a massive structure, the structure was zoned and the cement content in zones of lesser stress was reduced. Construction methods used in earthfill dams were adopted to place large quantities of concrete rapidly, thus building the dam in horizontal layers using construction equipment moving over concrete only a few hours old. Concrete batching, quality control, testing, and methods of placement are discussed. 1,715,310 cu m of concrete were placed, with an average daily production of 2210 cu m and a maximum of 3925 cu m. (USBR)
W71-01305

THE OPTIMUM GRAVITY DAM,
California Univ., Berkeley.
J. M. Raphael.
Paper Engineering Foundation Research Conference on Rapid Construction Concrete Dams (Asilomar, Calif, Mar 1970) Engineering Foundation, New York City. 20 p, 11 fig.

Descriptors: Dams, Dam design, Concrete dams, Earth dams, Production, *Gravity dams, Optimum design, Earth materials, Mass concrete, Strength, *Optimization, Soil properties, Cohesion, Internal friction, Costs, Soil cement, Soil stability.
Identifiers: Dam stability, Concrete properties, *Soil cement dams, Construction methods, Materials handling, Cement content, Slope angles.

Similarity of the angle of internal friction of concrete and consolidated gravels led to the speculation that concrete and rockfill may be extremes of a whole class of materials having varying degrees of cohesion, depending on the relative quantity of cementitious materials, and that concrete gravity dams and earthfill dams may be extremes of a whole class of gravity dams varying continuously from one to the other. A method is presented for finding the optimum gravity dam having a volume between the extremes of a concrete and an earthfill dam and made up of a material having a cement content between the extremes of zero for earthfill and the maximum content for concrete. Examination from the standpoints of production and materials properties shows a tremendous difference between costs and properties of earthfill and mass concrete materials. Data are presented showing: (1) how the slope of an earthfill can be influenced by varying cohesion, (2) the variation of cohesion with change in cement content, and (3) the variation of cost with change in slope. The total cost of an earthfill dam is relatively unaffected by enriching the fill material with cement in the flatter slope range (2:1 to 3:1); significant economies occur in the steeper slope range. (USBR)
W71-01306

PERKINS V VERMONT HYDRO-ELECTRIC CORP (LIABILITY FOR FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-01361

GENESYS - AN ATTEMPT TO RATIONALIZE THE USE OF COMPUTERS IN STRUCTURAL ENGINEERING,
Engineering Computations (England).
D. G. Alcock, and B. H. Shearing.
Structural Engineer, Vol 48, No 4, p 143-152, Apr 1970. 10 p, 10 fig, 9 ref.

Descriptors: *Structural design, *Structural analysis, Design tools, *Structural members, Structural engineering, Computer programs, Beams (Structural), Computer programming, Computers, Standards.
Identifiers: *Computer-aided design, Design practices, Computer applications, *GENESYS (Computer program), FORTRAN (Acronym).

GENESYS is a modular computing system developed to rationalize the use of computers in structural engineering. The system is machine independent to the user; the programming language used for GENESYS is GENTRAN, an extension of FORTRAN that deals automatically with a standard form of data. A command language is used to define new commands, permitting indefinite growth. Facilities are provided for filing information on tapes or discs, editing data, converting units, inserting variables in data, and controlling the layout of the printed page. All modules of a subsystem may refer to a digital model of the problem held in a central data bank. Virtual storage comes into play when the core storage overflows. New subroutines may be developed interpretatively before being compiled. Facilities for debugging and timing are available to the programmer. GENESYS may be used conversationally or conventionally in batch mode. (USBR)
W71-01390

SOME ARRANGEMENTS IN DESIGN AND CONSTRUCTION TO KEEP CONCRETE DAMS COMPETITIVE,
W. Ter Minassian, and P. Londe.
Pap, Eng Found Res Conf Asilomar Conf Grounds, Paris, France, 1970. 15 p, 3 tab.

Descriptors: *Concrete dams, Dams, *Dam construction, Dam design, Damsites, Concrete technology, Concrete placing, *Arch dams, *Diversion, *Multiple arch dams, Hydroelectric plants, Trenches, Dam foundations, Diversion works, Diversion tunnels, Prefabrication.
Identifiers: Cost savings.

The ultimate capital cost of a concrete dam can be kept much lower if the designer takes full advantage of all possibilities to reduce the volume of the dam, reduce construction difficulties, reduce construction time, and permit the earliest partial operation. Six major possibilities vital to keeping concrete dams competitive are discussed. (1) The increasing use of arch dams in wide valleys where previously only gravity dams were considered feasible has resulted in appreciable savings in concrete volume, formwork, and excavation area. (2) The use of multiple-arch design for very high dams incorporating large spans for the arches and cylindrical or conical shapes for simpler formwork has reduced the volume and cost of concrete. (3) Concrete dams can be built on sites where sound rock lies far below the surface by using open trenches, concrete shored trenches, or stoped adits to limit the volume of excavation. (4) Integrating the appurtenant works and powerplant in the common structure can be another element of financial economy, particularly where space is lacking. (5) River flow during construction can be handled with short diversion tunnels or by overtopping completed blocks. (6) Power generation can be started before completion of the dam without endangering the structure. (USBR)
W71-01391

Field 08—ENGINEERING WORKS

Group 8A—Structures

PEOPLE V STATE TAX COMM'N (VALIDITY OF FRANCHISE ASSESSMENT OF RAILROAD BRIDGE AS AFFECTED BY NAVIGABILITY OF RIVERS).
For primary bibliographic entry see Field 06E.
W71-01426

DOONER V UNITED STATES (ARTIFICIALLY INDUCED FLOOD DAMAGE).
For primary bibliographic entry see Field 06E.
W71-01428

LAWRENCE V CITY OF LA GRANGE (DAMAGES RESULTING FROM CITY DRAINAGE FACILITIES).
For primary bibliographic entry see Field 06E.
W71-01435

KENTON V MASSMAN CONST CO (LIABILITY FOR FLOOD DAMAGE CAUSED BY CONSTRUCTION OF A DIKE).
For primary bibliographic entry see Field 06E.
W71-01440

IN RE VICKSBURG BRIDGE AND TERMINAL CO (CORPORATIONS ABILITY TO MORTGAGE BRIDGE CONSTRUCTED ON STATE-OWNED RIVERBED).
For primary bibliographic entry see Field 06E.
W71-01449

SOUTH CAROLINA EX REL MAYBANK V SOUTH CAROLINA ELEC AND GAS CO (JURISDICTION OVER NAVIGABLE WATERS).
For primary bibliographic entry see Field 06E.
W71-01453

WINTER CONSTRUCTION FROM COHESIVE EARTH IN THE FAR NORTH (DAM-CORE CONSTRUCTION FOR THE VILYUI HYDROELECTRIC PLANT),
National Science Foundation, Washington, D.C. Special Foreign Currency Science Information Program.
E. N. Batenchuk, G. F. Biyanov, L. N. Toropov, and Yu. N. Myznikov.
Translated from Russian. Available from NTIS as TT-69-55098, \$3.00 in paper copy, \$0.95 in microfiche. Israel Program for Scientific Translations, Jerusalem, 1969. 73 p, 6 tab, 50 fig, 21 ref.
Identifiers: *Cold weather construction, Excavation, *Construction, Arctic regions, *Dams, USSR, Power plants (Establishments), Soil mechanics, Foundations (Structures), Freezing, Temperature, Permafrost, Quality control, Construction materials, Reinforced concrete.

Contents: General information on the hydrodevelopment; (Natural, climatic and geological conditions of the construction-site area, the hydrodevelopment structures); Dam materials; Search for a procedure for placing cohesive soils in winter; Dry filling of the dam core; Placing the loam into the dam core; Quality control during the placing of loam into the dam core; Some engineering and economic data on the winter placing of the loam dam-core fill.
W71-01512

CONTAINMENT AND COLLECTION DEVICES FOR OIL SLICKS,
Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
For primary bibliographic entry see Field 05G.
W71-01528

EFFECTS OF METHOD B BACKFILL ON FLEXIBLE CULVERTS UNDER HIGH FILLS: CHADD CREEK VOLUME 2 (APPENDICES),
California State Div. of Highways. Bridge Dept.
For primary bibliographic entry see Field 04A.
W71-01540

BRIDGEHEAD LAND CO V HALE (EFFECT OF EASEMENTS FOR ROAD CONSTRUCTION ON RIPARIAN RIGHTS).
For primary bibliographic entry see Field 06E.
W71-01592

8B. Hydraulics

UNSTEADY FREE-SURFACE FLOW COMPUTATIONS,
Michigan Univ., Ann Arbor. Dept. of Civil Engineering.
E. Benjamin Wylie.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7683, p 2241-2251, November 1970. 11 p, 6 fig, 12 ref, 2 append. NSF Project GK-721.

Descriptors: Unsteady flow, *Computer programs, *Mathematical studies, Hydraulics, Overland flow, Open channel flow, Routing, Flood routing.
Identifiers: *Onsteady free-surface flow.

The solution of the free-surface equations for subcritical unsteady one dimensional flow are solved by four different formulations, each based on the method of characteristics. Advantages and disadvantages of each procedure are given. Examples emphasize the important features and corroborate a stability criterion. The implicit characteristics grid approach is the most accurate for overland flow situations or analysis of single channels; however, it is not useful for complex systems. The explicit rectangular grid is the simplest to program but may lead to instabilities if very large/time increments are used, and it is comparatively expensive for long-duration transients. (Knapp-USGS)
W71-01108

VARIATIONAL APPROACH TO NON-DARCY FLOW,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
John A. McCorquodale.
ASCE Proceedings, Journal of the Hydraulics Division, Vol 96, No HY11, Paper 7694, p 2265-2278, November 1970. 14 p, 10 fig, 20 ref, 2 append.

Descriptors: *Darcys law, *Porous media, *Unsteady flow, *Groundwater movement, *Turbulent flow, Turbulence, Mathematical studies, Overland flow, Computer programs.
Identifiers: Variational calculus.

The principles of variational calculus are applied to solve the nonlinear partial differential equation for steady and unsteady unconfined non-Darcy flow through porous media. A functional is proposed which will yield solutions for the laminar, transitional and turbulent flow regimes. The solution represents the minimization of the rate of energy dissipation with enforced flow continuity. A finite element scheme is used to obtain the minimizing field. Examples of the method applied to steady and unsteady free surface flow is described in a rectangular rockfill section. The finite element and experimental flow fields are in good agreement. (Knapp-USGS)
W71-01109

INDETERMINATE HYDRAULICS OF ALLUVIAL CHANNELS,
Geological Survey, Tucson, Ariz.
For primary bibliographic entry see Field 02J.
W71-01110

DESIGN CRITERIA FOR CONTROLLED SCOUR AND ENERGY DISSIPATION AT CULVERT OUTLETS USING ROCK AND SILL,
South Dakota School of Mines and Technology, Rapid City.
Donald A. Thorson, and Arunprakash M. Shirole.
Available from NTIS as PB-190 564, \$3.00 in paper copy, \$0.95 in microfiche. 1969, 64 p.

Identifiers: *Roads, Drainage, *Erosion, Control systems, Rock (Geology), Kinetic energy, Offices, Jets, Model tests, Velocity, Design, Standards, South Dakota, Scouring, Culverts, Sills, Riprap, Energy dissipation, Stilling basins.

The study establishes the criteria for the effective design of rock-basin energy dissipators for flow from culverts without or with a transverse sill. Design-tables have been prepared on the basis of laboratory studies with culvert models. Models of standard end flares were used to simulate the culvert outlet conditions. Stable rock sizes and basin geometry can be determined using the design-tables developed in the study. The design-tables are applicable for angular rock as well as rounded rock. Worked examples use the tables for design of rock basins for no-scour situations and controlled depths of scour.
W71-01119

THE HYDRAULIC FILTER LEVEL OFFSET METHOD FOR THE FEEDBACK CONTROL OF CANAL CHECKS; COMPUTER PROGRAM FOR SYSTEM SIMULATION,
California Univ., Berkeley. Hydraulic Engineering Lab.

Michael J. Shand.
Available from NTIS as PB-189 480, \$3.00 in paper copy, \$0.95 in microfiche. June 1968. 132 p. Technical Report HEL-8-3. Contract DI-14-06-200-2337.

Identifiers: *Irrigation systems, Control systems, Liquid level control, Computer programs, Feedback, Check valves, Irrigation systems, Automatic, Mathematical models, Subroutines, *Irrigation canals, STAGAT computer program, CORNING computer program, Open channel control systems, Feedback control systems, *Automatic check gates.

The report describes a mathematical model which simulates unsteady flow in a trapezoidal canal with automatically controlled check gates between reaches. A computer program written for the model can be used to design, confirm and/or assist in modifying a control system for a particular canal. Flow charts and listings of the two source programs STAGAT and CORNING, required to make a complete study of a canal plus sample input and output data are included. The subroutine SETGAT that controls the check gate openings contains the calculations relating to the automatic downstream control systems. This control system involves a target water level established in a hydraulic filter well, which is connected by a capillary tube to the canal. The target value is the preselected depth of water in the canal at which the flow is zero and the gate is closed. A lowering of the water level in the hydraulic filter below the target value signals the upstream gate to open by an amount which is proportional to the offset from the target value. This ratio of the gate opening to the offset is the gain for the system. The subroutine SETGAT for any control system can be substituted provided the order of calculation within the subroutine remains the same.
W71-01130

LONG WAVE PROPAGATION IN A TRIANGULAR CHANNEL,
Naval Postgraduate School, Monterey, Calif.
William Toft Bowman.

Available from NTIS as AD-703 238, \$3.00 in paper copy, \$0.95 in microfiche. October, 1969. 46 p. MS Thesis.

Identifiers: *Shallow water, Water waves, *Water waves, Propagation, Laminar flow, Equations of motion, Hydrodynamics, Numerical analysis, Coriolis effect, Theses, Channel flow.

The purpose of the paper is to examine long wave propagation in a shallow channel of triangular cross section. Solutions for small scale (f&O), large scale (f not — O), symmetric and asymmetric channels are obtained. Results are shown to be consistent with earlier work for the fundamental mode (M — O), and with edgewave solutions over a gently slop-

ing bottom for the higher modes. A second class of waves (quasigeostrophic waves) is also obtained when the Coriolis effect is included. The results are compared with those for a rectangular channel.
W71-01137

DISPERSIVE LONG WAVES OF FINITE AMPLITUDE OVER AN UNEVEN BOTTOM,
Massachusetts Inst. of Tech., Cambridge.
Ole Secher Madsen, and Chiang C. Mei.

Available from NTIS as AD-700 301, \$3.00 in paper copy, \$0.95 in microfiche. November 1969. 10 p. Report No. 117.

Identifiers: *Water waves, Hydrodynamics, *Structures, Water waves, Design, Numerical analysis, Nonlinear systems, Beaches, Equation of motion, Theses.

Approximate equations for long waves are derived under assumptions similar to those of Boussineq and Korteweg and de Vries. Numerical studies are performed using the method of characteristics. Four cases are investigated (1) solitary wave on a beach, (2) solitary wave on a shelf, (3) periodic waves generated in a wave tank of constant depth, (4) periodic wave on a shelf. It is discovered that complicated disintegration and evolution appear due to combined effects of nonlinearity and dispersion. Experimental evidence is presented.
W71-01157

HYDRAULIC STUDY OF FIVE FLOATING BREAKWATERS FOR USE IN RESERVOIRS,
California Univ., Berkeley. Hydraulic Engineering Lab.

Kenneth Chen, and Robert L. Wiegel.

Available from NTIS as PB-189 779, \$3.00 in paper copy, \$0.95 in microfiche. 30 September 1969, 25 p. HEL 20-2.

Identifiers: *Hydraulic accumulators, Water waves, *Breakwaters, Design, Mobile, Floating bodies, Mooring, Hydraulic models, Model tests, Dams, Performance (Engineering), California, *Floating breakwaters.

The report presents the results of hydraulic model tests of five floating breakwater models performed in the Hydraulic Engineering Laboratory, University of California, Berkeley, California, during January-June 1969. First, a study was made of numerous papers and reports on mobile breakwaters during the latter part of 1968. Based upon this work, three rigid floating breakwaters were designed, each based on a different concept of wave energy dissipation and reflection. The performance of each model is discussed.
W71-01170

ALLUVIAL RIVER BEHAVIOR - A FEW ASPECTS OF ITS SIMULATION IN A MODEL,
S. N. Gupta, J. P. Sharma, S. R. Jindal, and Satish Chandra.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 267-275, 1969. 9 p, 4 fig, 1 tab, 4 ref.

Descriptors: *Hydraulic models, *River training, *Alluvial channels, *Meanders, *Dikes, Sediment transport, Stream stabilization, River regulation, Hydraulic similitude, Sediment transport.
Identifiers: India.

A number of training spurs, for alluvial river loops of varying arc/chord ratios, carrying flood flows to the extent of 0.6 million cfs, were designed with the aid of models at Bahadradab Hydraulic Research Station of U. P. Irrigation Research Institute, Roorkee, India. The river was simulated in a model and the behavior of training spur was interpreted from the model study. The model indicated only that the river would be deflected favorably by the proposed repelling spurs, but actually the river shifted by an appreciable distance in the first flood season. In the

case of Yamuna River at Lakhnauti embankment, the spurs, constructed after the study of river curvature from the actual site survey, shifted the river to a similar extent. Using the data of eight river loops where minimum lengths of repelling spurs were determined either with the aid of models or after study of river surveys, an empirical relationship was developed for calculating the required length of a spur to control river loops. (Knapp-USGS)
W71-01211

SIMULATION TECHNIQUES IN WATER RESOURCES SYSTEMS,

State Hydraulic Works, (Turkey). Dept. of Research.

For primary bibliographic entry see Field 02E.
W71-01215

ELECTRONIC ANALOGUES REPRESENTING NONLINEAR FLOW THROUGH OPEN CHANNELS AND FLOOD CONTROL STRUCTURES,
Central Water and Power Research Station, Poona (India).

K. V. Ramana Murthy.

French resume. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 247-258, 1969. 12 p, 7 fig, 9 ref.

Descriptors: *Analog models, *Open channel flow, *Unsteady flow, Spillway crests, Waves (Water), Water storage, Hydraulics, Mathematical studies, Flood routing, Flood control, Water management (Applied), Reservoir operation, Hydrograph analysis.

Identifiers: Spillway flow.

Flow through open channels and flood control structures is governed by nonlinear laws. The resistance to flow decreases with increase in flow in open channels, resulting in the phenomena often accounted for by wave celerity and wedge storage. Because of the nonlinear relationship between head and discharge over spillway crests, the time of emptying decreases with increase in discharge. Electronic analogs taking into account these nonlinear characteristics are presented and their practical applicability is illustrated. (Knapp-USGS)
W71-01217

A MATHEMATICAL MODEL OF UNSTEADY FLOW IN A NATURAL OR ARTIFICIAL WATER COURSE,

Vattenbyggnadsbyran, Stockholm (Sweden).

For primary bibliographic entry see Field 02E.
W71-01224

AMPLITUDE-DISSIPATIVE AND PHASE-DISSIPATIVE SCHEMES FOR HYDRAULIC JUMP STIMULATION,

Technische Hogeschool, Delft (Netherlands).

M. B. Abbott, G. Marshall, G. S. Rodenhuis, and T. Ohno.

French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 1 (Subject A), Science Council of Japan, Kyoto, p 313-319, 1969. 7 p, 5 fig, 8 ref.

Descriptors: *Equations, *Hydraulic jump, *Mathematical models, Simulation analysis, Mathematical studies, Continuity equation, Transition flow, Surges, Standing waves, Open channel flow.
Identifiers: Boussinesq equation.

For hydraulic jumps of short wave length and nearly-horizontal flow, depths and velocities can only be given their mean values, and calculation schemes that are not amplitude-dissipative can be used. Such schemes are 'non-linearly dissipative' in that their properties cannot be calculated by Fouri-

er representation, but have more tendency towards consistency with the Boussinesq equation. (Knapp-USGS)

W71-01225

HYDRAULIC CHARACTERISTICS OF TSUNAMI ACTING ON DIKES,
Ministry of Agriculture and Forestry, Yawata (Japan). Agricultural Engineering Research Station.

Makoto Nakamura, Hidehiko Shiraishi, and Yasuo Sasaki.

French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 45-59, 1969. 15 p, 13 fig.

Descriptors: *Tsunamis, *Bores, *Waves (Water), *Dikes, Ocean waves, Hydraulic models, Floods, Seiches, Flood control, Hydraulic structures, Shore protection.

Identifiers: Japan, Wave forces.

In the vicinity of shore lines, concentration of energy makes tsunami height very large. Tsunami can be classified into two types, i.e. the 'Seiche type' in which energy is conserved in great height duplicated by seiche motion and the 'Progressive breaker type' in which the tsunami progresses in the form of a bore. This paper presents the conventional formulas and necessary data to estimate the tsunami pressure acting on a dike, the tsunami height, the tsunami run-up on a dike and the quantity of overflow discharge across a dike crown. The type of tsunami used in a hydraulic model was the progressive breaker type in which tsunami have the strongest destructive power against shore land. This model study was confirmed by study of the Tokachi-oki Earthquake tsunami, which attacked the northeastern coast of Japan in May 1968. (Knapp-USGS)
W71-01243

STANDING LONG WAVES OF FINITE AMPLITUDE,

Chuo Univ., Tokyo (Japan). Dept. of Civil Engineering.

Nobuo Shuto.

French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 13-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 77-84, 1969. 8 p, 1 tab, 1 ref.

Descriptors: *Waves (Water), *Standing waves, *Mathematical studies, Ocean waves, Shore protection, Mathematical models.
Identifiers: Standing long waves.

The problem of standing long waves of finite amplitude is analyzed. When the relative depth d/L is smaller than about 0.15, the accuracy of solutions of standing surface waves is not satisfactory. The perturbation method with respect to the relative depth gives more accurate results. The problem may be reduced to that of the interaction of waves with conic-section forms. Physical quantities such as surface elevation, water particle velocities, wave velocity and wave pressure are given, up to the second order of approximation, by using the Jacobian elliptic functions and the Zeta-function. (Knapp-USGS)
W71-01246

ON THE EFFECT OF OFUNATO TSUNAMI-BREAKWATER AGAINST 1968 TSUNAMI,

Ministry of Transportation, Yokosuka (Japan). Port and Harbour Research Inst.

Yoshiyuki Ito.

French resume included. In Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 85-93, 1969. 9 p, 5 fig.

Field 08—ENGINEERING WORKS

Group 8B—Hydraulics

Descriptors: *Tsunamis, *Harbors, *Shore protection, *Mathematical models, Waves (Water), Floods, Water level fluctuations, Data collections, Profiles, Coastal structures.
Identifiers: Wave recorders, Japan.

The construction of tsunami-breakwater in Ofunato Harbour, Japan was proposed after Chilean Earthquake Tsunami in 1960. The effect of breakwaters against tsunami was studied by numerical calculations. In May 1968, this tsunami breakwater experienced the first tsunami since its completion in 1967. Water level elevations were obtained by two recorders, outside and inside the breakwater. The incident tsunami profile was calculated and compared with observations at the outside recorder. Then, after confirming a good agreement between calculation and observation at the inside recorder, the water level and velocity distribution was computed for the harbor before the construction of the breakwater. Thus, the effect of the existing breakwater was definitely estimated. If no breakwater had been constructed in this harbor, the highest water level would have been increased to almost twice the actual one. (Knapp-USGS) W71-01247

THE INFLUENCE OF FRICTION ON THE PROPAGATION OF TIDES (FRENCH),
Politecnico di Torino (Italy). Inst. of Hydraulics and Hydraulic Construction.
For primary bibliographic entry see Field 02L.
W71-01248

A NUMERICAL MODEL OF A WIDE SHALLOW ESTUARY,
For primary bibliographic entry see Field 02L.
W71-01250

TRANSFORMATION AND RUN-UP OF TSUNAMI TYPE WAVE TRAINS ON A SLOPING BEACH,
Tetra Tech, Inc., Pasadena, Calif.
Li-San Hwang, Samuel Fersht, and Bernard Le Mehaute.
French resume included. In: Proceedings 13th Congress of the International Association for Hydraulic Research, Kyoto, Japan, August 31-September 5, 1969, Vol 3 (Subject C), Science Council of Japan, Kyoto, p 131-140, 1969. 10 p, 7 fig, 10 ref. AEC Contract No AT (26-1)-289.

Descriptors: *Tsunamis, *Waves (Water), *Ocean waves, *Surf, *Beaches, Frequency analysis, Equations, Mathematical models, Mathematical studies, Coastal engineering, Beach erosion, Shore protection, Flood protection.
Identifiers: Wave run-up (Beaches).

The problem of transformation of non-periodic wave trains from a surface deformation on a uniform sloping beach was analyzed based on nonlinear shallow water wave equations. Numerical results were obtained for various locations on the sloping beach as well as at the shoreline. These calculations indicate the existence of a strong beating phenomenon of a lower frequency than that of the incident wave. This is due to the interaction between the incident and the reflected waves from the sloping beach. The intensity of the beating phenomenon decreases toward the shoreline, and vanishes at the shore. Numerical calculations of nonlinear effects on the wave profile and wave breaking are presented and discussed. Experimental results are introduced and compared. (Knapp-USGS) W71-01259

TURBULENT DISPERSION IN PERIODIC FLOW,
Kyushu Univ., Fukuoka (Japan). Dept. of Hydraulic Civil Engineering.
For primary bibliographic entry see Field 02L.
W71-01261

FLOW IN CONDUITS WITH LOW ROUGHNESS CONCENTRATION,
Washington State Univ., Pullman.
J. A. Roberson, and C. K. Chen.
Proc Amer Soc Civ Eng, J Hydraul Div, Vol 96, No HY4, p 941-957, Apr 1970. 17 p, 12 fig, 12 ref, 3 append.

Descriptors: Conduits, Drag, *Fluid flow, Fluid mechanics, Fluid friction, Hydraulics, *Flow resistance, *Pipe flow, Reynolds number, Roughness coefficient, *Roughness (Hydraulic), Turbulent flow, Equations, Velocity distribution, Bibliographies, Analytical techniques.
Identifiers: Shear distribution, Surface resistance, Drag-force.

The ultimate objective in the analytical study of flow in rough conduits is the ability to predict the resistance to flow as a function of the geometric characteristics of the conduit surface, the fluid properties, and the rate of flow. A procedure for obtaining overall resistance for flow in conduits roughened with discrete geometric elements is presented. The basic laws for turbulent flow in conduits and the relationship between the drag of blunt bodies and the velocity of flow past the bodies were utilized to obtain transition functions that relate the friction factor and relative roughness to the Reynolds number. Solutions are presented for boundaries roughened with cubes and spheres. Results are generally consistent with experimental results obtained by Koloseus, O'Loughlin, and Schlichting. (USBR) W71-01304

FLOW OVER ROUND CRESTED WEIRS,
Chile Univ., Santiago.
S. Montes.
L'Energia Elettrica, Vol 47, p 155-164, Mar 1970. 10 p, 11 fig, 2 tab, 21 ref.

Descriptors: *Weirs, Hydraulic design, Hydraulic structures, *Fluid flow, Hydraulic engineering, *Discharge measurement, Bibliographies, Discharge coefficients, Experimental data, Pressure distribution, Nappe, Velocity, Sharp crested weirs.
Identifiers: *Round-crested weirs, Boundary conditions.

Round-crested weirs represent an important part of the structures used in hydraulic engineering. The well-known family of so-called Creager profiles belongs in this category. Numerous applications of round-crested weirs are available for determining discharge for hydrological, agricultural, and industrial purposes. The use of round-crested weirs in the laboratory has certain advantages over the sharp-crested variety, especially for very small heads. The slightly larger coefficient of discharge of round-crested weirs may be advantageous. A method of predicting discharge coefficients, velocities, and pressure distribution over the crest section for round-crested weirs is offered. The method is based on certain published principles that in theory were not developed sufficiently for practical use. The author has endeavored to overcome this defect. Has 21 references. (USBR) W71-01314

FLOW DISTRIBUTION IN STREET INTERSECTIONS AS DETERMINED BY EXPERIMENTAL HYDRAULIC MODEL STUDIES.
Los Angeles Bureau of Engineering, Calif. Storm Drain Div.
For primary bibliographic entry see Field 02E.
W71-01334

ANALYSIS AND MODEL TESTS TO DETERMINE FORCES AND MOTIONS OF AN OIL RETENTION BOOM,
Hydronautics, Inc., Laurel, Md.
W. T. Lindenmuth, O. J. Scherer, and P. Van Dyke.
Available from NTIS as AD-702 512, \$3.00 in paper copy, \$0.95 in microfiche. Technical Report 948-1 (I), January 1970, various pagings. 5 ref. Contract DOT-CG-93907-A.

Identifiers: *Water pollution, Control systems, *Petroleum, Water pollution, *Floating bodies, Performance (Engineering), Motion, Mathematical analysis, Cylindrical bodies, Loading (Mechanics), Wind, Ocean currents, Force (Mechanics), Ocean waves, Programming (Computers), Configuration, Model tests, Curve fitting, *Oil retention booms, *Oil spills.

A theoretical analysis of the loads and motions of a continuous, elastic, oil retention boom of arbitrary configuration is presented. The boom is subjected to loads of wind, current, and an irregular sea. The analytical method was programmed for computer and used to generate data for a variety of oil booms. Towing tank tests were conducted on selected boom configurations and serve to check the theoretical analysis.
W71-01527

HYDRAULICS OF LOW-GRADIENT BORDER IRRIGATION SYSTEMS,
Colorado State Univ., Fort Collins. Natural Resources Center.
For primary bibliographic entry see Field 02G.
W71-01545

8C. Hydraulic Machinery

HYDRAULIC MODEL STUDIES OF AN ENERGY DISSIPATOR FOR A FIXED CONE VALVE AT THE UTE DAM OUTLET WORKS,
Bureau of Reclamation, Denver, Colo. Office of Chief Engineer.
For primary bibliographic entry see Field 08A.
W71-01142

RESEARCH NEEDS IN THE CIVIL ENGINEERING ASPECTS OF POWER.

Proc Amer Soc Civ Eng, J Power Div, Vol 96, No PO2, p 187-276, Feb 1970. 90 p, 4 tab, 83 ref, 3 append.

Descriptors: *Civil engineering, *Research and development, Safety, Air pollution, *Electric power production, Pumped storage, Pollutants, Waste disposal, Water pollution, Hydroelectric power, Water quality, Optimum development plans, Resource development, Nuclear powerplants, Bibliographies, Laboratory tests, Test facilities, Thermal power, Fuels.
Identifiers: Air pollution control, Nuclear power.

Research needs in the civil engineering aspects of power are reviewed and cataloged in a report developed by the Power Division Research Committee of the American Society of Civil Engineers and presented in panel meetings at a Specialty Conference at the University of Washington, Pullman, in Sept 1968. The panel reports cover optimal development of resources, fuels and air quality control, water quality control, use and disposal of wastes, safety and security of powerplants, pumped storage, and test facilities. Three appendices present abstracts of the luncheon speeches, the program of events and presentations, and a list of attendees and contributors. (USBR) W71-01318

GENERAL SURVEY OF HVDC PROJECTS,
Central Electricity Generating Board (England)
C. C. Tam.
Direct Curr, Vol 1, No 4, p 128-132, 1970. 5 p, 2 fig, 1 tab, 12 ref.

Descriptors: *Direct current, Extra high voltage, Foreign countries, *Transmission (Electrical), *Reviews, *Extra long distance, Histograms, Hydroelectric power, Research and development, Converters (Electrical), Electric power production.
Identifiers: *High voltage, Installed capacity, Great Britain, France, Sweden, Canada, Power losses, Japan, USSR, Thyristors.

A world survey of hvdc in electric power transmission includes projects built since 1954 and those proposed through 1980. Critical views are given of different technical possibilities and the commercial aspects of hvdc transmission. During the first 15 yr, the rating of mercury arc valves has increased from 20 mw (Gotland) to 270 mw (Nelson River) and the application has become worldwide. By 1980, the highest rated scheme (Ekibastuz, USSR) will be 300 times that of the Gotland scheme. During 1960-69, the rate of installation of hvdc schemes was nearly one each year. For 1970-79, present information suggests about the same rate of installation, but the total installed capacity will increase more than 5 times. A comprehensive table including details of all existing projects, a histogram, and a graph of the growth of transmitted capacity by hvdc up to 1980 are given. (USBR) W71-01388

8D. Soil Mechanics

SOME DESIGN CONSIDERATIONS IN THE SELECTION OF UNDERGROUND SUPPORT SYSTEMS,

Illinois Univ., Urbana. Dept. of Civil Engineering. R. B. Peck, D. U. Deere, J. E. Monsees, H. W. Parker, and B. Schmidt. Available from NTIS as PB-190 443, \$3.00 in paper copy, \$0.95 in microfiche. Various pagings, November 1969. DOT Contract No 3-0152. Identifiers: *Underground structures, Design, *Supports, Anomalies, Soil mechanics, Water, Underground, Rock (Geology), Soils, Reinforcing materials, Costs, Earthmoving equipment, Decision making, Cost effectiveness, *Tunnels.

Guidelines for the design of supports for underground openings in both soil and rock are presented and discussed for several specific situations. The design and construction of both shafts and tunnels are examined. The problems that may occur because of unusual or variable geologic conditions are outlined and the effects of these geologic anomalies on the construction scheme are indicated. Other situations considered include multiple parallel tunnels and crossed tunnels as well as intersections and enlargements of tunnels. Support systems and construction methods which can be easily modified to adapt to variable conditions and requirements are also discussed. The cost of tunnel support systems is evaluated and compared to the total cost of the tunnel. The cost relationships are illustrated by numerous detailed cost estimates of tunnels in both soil and rock. Finally, the problems of ground movements around soft ground tunnels are discussed and methods for predicting the magnitude of settlement over soft ground tunnels are presented. (USBR) W71-01145

LOCATING AND TRACING SEEPAGE WATER IN UNSTABLE SLOPES,

Kentucky Dept. of Highways, Lexington. Div. of Research. Yasin A. Alkhoa, and Gordon D. Scott. Available from NTIS as PB-190 620, \$3.00 in paper copy, \$0.95 in microfiche. February 20, 1970. 38 p. Identifiers: *Pavements, Foundations (Structures), *Terrain, Stabilization, *Soils, Drainage, Avalanches, Shear stresses, Failure (Mechanics), Costs, Effectiveness, Tracer studies, Dyes, Detection, Resistance (Electrical), Kentucky, Embankments, Groundwater.

The objective of the study was the development of a practical method of locating and tracing seepage water in unstable slopes. The study consisted of testing several methods at side-hill fill locations where the highway was distressed. In each case, construction of the fill had blocked drainage. The results of the study indicate the following: Clean, fine sand did not remove fluorescent dye from solution for moderate percolation distances, but the dye became somewhat less detectable due to its absorption by the sand for longer percolation

distances. The conventional monitoring equipment (ultraviolet light) was not sufficiently efficient to monitor low concentrations of the dye. The tracer method was not dependable for the purpose of locating seepage waters and was shown to require further improvement. However, it was used to verify a suspected source of seepage when the ground-water was believed to have traveled through defined channels or very porous material. The water table observation method was the most definitive and useful of the methods studied for tracing and locating seepage water. The electrical resistivity method did not yield very accurate and dependable results without correlation with actual site moisture conditions. With more and better selection of sampling holes and resistivity observations, more useful results could be obtained from this method. (USBR) W71-01146

IN SITU STRENGTH OF ROLLED AND HYDRAULIC FILL,

National Building Research Inst., Pretoria (South Africa). G. E. Blight. Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM3, p 881-899, May 1970. 19 p, 11 fig, 23 ref, append.

Descriptors: *Hydraulic fills, *Rolled fills, *Compaction, *Earth dams, Fills, *Shear strength, Anisotropy, Soil mechanics, Vane shear tests, Embankments, *Slope stability, Gypsum, Fly ash, Mine wastes, Bibliographies, Isotropy. Identifiers: Tailings.

Rolled and hydraulic fill usually have anisotropic in situ strength characteristics. The strengths on horizontal and vertical planes in an anisotropic soil may be evaluated by vane shear tests with vanes of different shapes. Tests show that in situ strength of recently compacted fill is anisotropic because of in-place stress conditions, although the soil is intrinsically isotropic. In a 34-year old embankment tested, however, in situ strength was isotropic although the soil was intrinsically anisotropic. In situ strength of hydraulic fill is anisotropic in such a way as to correspond to K sub O consolidation. After construction, stresses in a compacted embankment are modified by plastic creep of the soil which, in turn, modifies the strength characteristics of the soil. Predicted strengths in a newly compacted fill correspond with the strength on horizontal planes in the embankment. The predicted long-term strength in an embankment agreed with measured in situ strengths below the water table. Above the water table, in situ strength can be enhanced by the effects of evaporation from the surface of the embankment. Has 23 references. (USBR) W71-01301

THE OPTIMUM GRAVITY DAM,

California Univ., Berkeley. For primary bibliographic entry see Field 08A. (USBR) W71-01306

DERWENT DAM—DESIGN CONSIDERATIONS—CONSTRUCTION—EMBANKMENT STABILITY AND DISPLACEMENTS,

Sunderland and South Shields Water Co.; and Manchester Univ. (England). N. J. Ruffe, N. Buchanan, and P. W. Rowe. Inst Civ Eng Proc, Vol 45, p 381-452, Mar 1970. 72 p, 53 fig, 8 tab, 28 ref, 2 append.

Descriptors: Foreign construction, Bibliographies, *Dam construction, Dams, *Dam design, Dam foundations, *Earth dams, Cutoffs, Sand drains, Foundation investigations, Engineering geology, Vertical drains, Relief wells, Grouting, Dewatering, Pervious blankets, Borrow areas, Stability analysis, Slope protection, Instrumentation, Soil properties, Soil tests.

Identifiers: Great Britain, Dam stability, Seepage control, Pumping tests, Design modifications, Construction control, Derwent Dam, Gt Brit.

Derwent Dam is a 3000-ft-long, 119-ft-high earth dam on the Derwent River in Great Britain. Three papers describe: (1) the design and changes during construction of the cutoff and embankment; (2) the strengthening of a weak foundation by installing 4475 vertical sand drains, changed construction caused by elimination of a concrete cutoff under the central section of the dam, details about placing and testing various materials, construction and performance of an extensive system of measuring devices, and original cost estimates and final payments; and (3) a critical examination of results of conventional site investigation and laboratory testing procedures in light of performance of a large earth dam on a deep, soft clay foundation and stability, performance, and engineering properties of the foundation and fill. Close achievement of design objectives for the embankment shows that the behavior of soft foundation soils can be predicted and controlled, provided attention is given to the detailed geological features. Has 28 references. (USBR) W71-01312

EFFECT OF A POLYMER ON THE PROPERTIES OF SOIL-CEMENT,

Bureau of Reclamation, Denver, Colo. C. W. Jones. Bureau of Reclamation Report REC-OCE-70-18, May 1970. 11 p, 6 fig, 7 tab, 2 ref.

Descriptors: *Soil cement, *Polymers, Soil compaction, Soil tests, Soil physical properties, Soil stabilization, Permeability, Cements, Unconfined compression, Impregnation, Compressive strength, Soil strength, Canal linings, Riprap, Cracking, Freeze-thaw tests. Identifiers: Methyl methacrylate, Vinyl acetate, Acetates, Polymer concretes, *Concrete-polymer materials, Polymerization.

A laboratory testing program was conducted on soil-cement specimens of silty sand and of silt with the monomer methyl methacrylate (MMA) added and polymerized. The purpose was to determine any beneficial effects on the properties of soil-cement as used in Bureau of Reclamation construction. By the preformed method, some specimens were impregnated with MMA and polymerization was by gamma radiation from Cobalt 60. Other specimens by the premix method had 3% or 6% MMA with 1% benzoyl peroxide as a catalyst incorporated during specimen preparation; polymerization was by heat. The compressive strength of the preformed specimens containing silty sand was increased about 3.4 times that of specimens without MMA, but the premix specimens did not increase in strength. Results of freeze-thaw tests did not show conclusive trends, but there were indications of improvement with the addition of MMA. The MMA reduced significantly the permeability of the silty sand specimens. Petrographic examinations showed that the MMA penetration and filled the voids of portions of the silty sand specimens, but the voids in the silt specimens were nearly empty. (USBR) W71-01317

DEVELOPMENT OF FAILURE AROUND EXCAVATED SLOPES,

California Univ., Berkeley. P. Dunlop, and J. M. Duncan. Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM2, p 471-493, Mar 1970. 23 p, 22 fig, 1 tab, 17 ref, 2 append.

Descriptors: *Slopes, Clays, Overconsolidation, *Excavation, Failure (Mechanics), Stability, Stress distribution, Analysis, Shear strength, Stress-strain curves, Theoretical analysis, Bibliographies, *Slope stability.

Identifiers: *Finite element method.

Nonlinear analyses of stresses around slopes excavated in clay, performed using the finite element method, have been used to determine where failure begins and how the failure zone enlarges as excavation continues. The stress-strain and strength

characteristics are represented in the analyses by stress-strain curves consisting of 2 straight lines, and the analyses are conducted in a series of increments simulating successive stages of excavation. Results show that the location of the first failure and the manner in which the failure zone enlarges depend on the initial stress conditions before excavation and the manner in which the shear strength of the clay varies with depth. The analysis indicates that the development of failure around slopes excavated in overconsolidated clay is considerably different from the development of failure around slopes in normally consolidated clay. (USBR)
W71-01320

METHOD FOR PREDICTING INITIAL SETTLEMENT,

Massachusetts Inst. of Tech., Cambridge.
D. J. D'Appolonia, and T. W. Lambe.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM2, p 523-544, Mar 1970. 22 p, 16 fig, 2 tab, 22 ref, 2 append.

Descriptors: Clays, Theory, Strain, Anisotropy, Shear strength, Stress-strain curves, Laboratory tests, Stiffness, Bibliographies, Theoretical analysis, *Settlement, *Settlement (Structural), Soil mechanics, Stress.
Identifiers: Stress paths, Finite element method, Soil modulus, Boundary conditions, Undrained shear strength.

A method of analysis is developed for predicting initial settlement caused by strains that occur within soil that remains at constant volume. The method employs finite element analysis and includes: (1) stress and displacement boundary conditions; (2) soil nonlinearity, nonhomogeneity, and anisotropy; and (3) initial gravity stress in the soil. A sample problem is used as a vehicle for indicating qualitatively the importance of initial anisotropic gravity stresses and undrained strength anisotropy with rotation of principal planes to settlement prediction and actual settlement behavior. Also considered is the sensitivity of load-deformation predictions to uncertainties in soil modulus and shear strength. The load-settlement behavior of a footing on clay depends on the stress-strain modulus and the initial state of stress in the soil. The soil modulus in laboratory tests is subject to major uncertainties. (USBR)
W71-01321

SAFETY ANALYSIS OF SLOPES,

Ohio State Univ., Columbus.
T. H. Wu, and L. M. Kraft, Jr.
Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM2, p 609-630, Mar 1970. 22 p, 12 fig, 4 tab, 40 ref, 3 append.
Identifiers: *Slopes, Stability, Analysis, *Safety factors, Economics, Statistical analysis, Errors, Bibliographies, *Slope stability, Costs, Soil properties.

Research on soil properties and analysis of slope stability have thrown light on the uncertainties and errors of many assumptions commonly adopted in practice. The study considers a problem in slope stability that is designed by a set of procedures deemed representative of current practice, and called conventional practice. Various uncertainties and errors are evaluated from published research results, and are used to compute the failure probability of slopes designed according to conventional practice. Statistical decision theory is used to obtain the optimum safety factor and the expected cost. Results also show the effect of uncertainties on the optimum design and the expected cost. The study illustrates one approach in the application of research results to practice and the evaluation of benefits gained from research. (USBR)
W71-01322

SEISMIC RESPONSE OF SOIL DEPOSITS,

Woodward-Clyde and Associates, Oakland, Calif; and California Univ., Berkeley.

I. M. Idriss, and H. B. Seed.

Proc Amer Soc Civ Eng, J Soil Mech Found Div, Vol 96, No SM2, p 631-638, Mar 1970. 8 p, 6 fig, 12 ref, 2 append.

Descriptors: *Seismic investigations, *Damping, Elasticity modulus, Analysis, Theoretical analysis, Seismic studies, Seismic waves, Soil mechanics, *Soil investigations, Soil properties.
Identifiers: Site selection, Seismic tests, Seismic prospecting, *Soil deposits, Soil modulus.

An analytical procedure for evaluating the seismic response of horizontal soil layers incorporating equivalent linear moduli and damping ratios varying with depth is presented. The use of this procedure is illustrated and results are compared to recorded values and to computed values using a constant damping solution. The comparisons indicate that the variable damping solution often provides response values that are in better agreement with recorded values than those obtained from a constant damping solution. The difference does not appear to be great when the deposit consists of soils that are essentially similar; much greater differences are obtained when the deposit consists of sublayers that vary greatly. (USBR)
W71-01323

EMERGENCY MEASURES AT LLEST WEN RESERVOIR,

D. G. Gamblin, and A. L. Little.
Water and Water Engineering, Vol 74, No 889, p 93-101, Mar 1970. 9 p, 4 fig, 6 photo, append.

Descriptors: *Earth dams, *Dam failure, Pumping, Inspection, Grouting, Safety, Foreign countries, Sinkholes, Subsidence, Reservoirs, Repairing, Seepage, Leakage, Reservoir leakage, Drawdown, Outlet works.
Identifiers: Piping (Erosion), *Remedial treatment, Great Britain.

Llest Wen Dam in Great Britain consists of a 70-ft-high, puddle clay core earth embankment; a 110-ft-wide overflow spillway; and outlet works. The outlet works include a 15-in.-dia water supply main supplied by a wet and dry chamber and valve shaft arrangement containing sluice valves at different levels to a 15-in.-dia vertical stand pipe. The water supply main and a 6-in.-dia shaft drainpipe pass through the puddle core and into a tunnel under the downstream shoulder of the dam. A large hole was discovered in the embankment upstream from the puddle core near the valve shaft. Inspections revealed a break in the 6-in. drainpipe near the center of the puddle core and clay in the drainage water. The 15-in.-dia outlet pipe was inadequate for lowering the reservoir water surface. Emergency operations to lower the water surface under difficult weather and access conditions by pumping, lowering the spillway elevation, and diverting inflow into an unmaintained bypass channel are described. Temporary remedial construction was to lower the reservoir water surface and spillway elevation by 30 ft, grout in the area of the valve shaft, concrete line the spillway channel, and repair the reservoir inflow bypass channel. (USBR)
W71-01381

A FINITE ELEMENT APPROACH TO ELASTIC SOIL-STRUCTURE INTERACTION,

Manchester Univ. (England).
Ian M. Smith.
Can Geotech J, Vol 7, No 2, p 95-105, May 1970. 11 p, 15 fig, 5 tab, 18 ref.

Descriptors: Elastic deformation, *Foundations, Footings, Deflection, Cohesionless soils, Structures, *Soil mechanics, Soil pressure, Pressure distribution, Correlation techniques, Bibliographies, Foreign research, Theoretical analysis.

An application of the displacement finite element method to axisymmetric soil-structure interaction problems is described. Because the structure and foundation are analyzed as an entity, the distribution of contact pressure does not have to be as-

sumed. The accuracy of the method is first assessed in the analysis of some simple problems to which other solutions exist. Then a series of laboratory results and one field case record, all involving flexible structures bearing on cohesionless foundations, are analyzed, the foundations being treated as elastic but inhomogeneous. Winkler and elastic solid foundations are considered. For elastic solid foundations, physically reasonable distributions of the elastic modulus do not lead to very good predictions of the deflections of the structure, although the deflections within the foundation agree with observed values. (USBR)
W71-01392

8E. Rock Mechanics and Geology

SOME DESIGN CONSIDERATIONS IN THE SELECTION OF UNDERGROUND SUPPORT SYSTEMS,

Illinois Univ., Urbana. Dept. of Divl Engineering.
For primary bibliographic entry see Field 08D.
W71-01145

RESERVOIR RIM STABILITY - LAKE ROOSEVELT. COLUMBIA BASIN PROJECT.

Bureau of Reclamation, Denver, Colo.
Available from NTIS as PB-193 524, \$3.00 in paper copy, \$0.95 in microfiche. November 1969. 24 p.

Identifiers: *Lakes, *Avalanches, Photographs, Erosion, Hazards, Clay, Silt, Sand, Washington (State), Dams, Stabilization, Lake Roosevelt, Columbia Basin Project, *Reservoirs, *Banks (Waterways), *Landslides.

Lake Roosevelt first reached its maximum elevation of 1290 feet above sea level on July 15, 1942 following the completion of Grand Coulee Dam in 1941. In 1968 water requirements downstream and needs for power generation resulted in a drawdown to about elevation 1200. In the spring of 1969 construction of the Third Powerplant at Coulee Dam required a maximum drawdown to elevation 1160. The drawdown was below elevation 1170 for six weeks. A similar drawdown is planned for 1973. Several factors have caused increased activity in landslide surveillance in recent years. Historically, the river valley has been subject to extensive degradation due to landslide activity. The large drawdowns of 1968, 1969, and 1970, the increased use of the lake area for recreation, industry, farming, and municipal growth, and a major slide in 1969 now warrant a closer look at the potentially increased hazards and problems. The purpose of the report is to briefly review the landslide and regression problems and to describe management's efforts to maximize the use of the lake resource and at the same time reduce hazards and encroachments to a minimum with a more progressive acquisition program.
W71-01154

SPECTRAL SIMULATION AND EARTHQUAKE SITE PROPERTIES,

Bell Telephone Labs., Inc., Whippany, N.J.
S. C. Liu, and D. P. Jhaveri.
Proc Amer Soc Civ Eng, J Eng Mech Div, Vol 95, No EM5, p 1145-1168, Oct 1969. 24 p, 15 fig, 3 tab, 8 ref, 2 append.

Descriptors: *Earthquakes, Models, Statistical analysis, Theoretical analysis, *Seismic investigations, Damping, Seismic studies, *Earthquake engineering, Seismic design.

Analytic results of studies on site properties and use in ground motion prediction and simulation are presented. Spectral simulations of random-type ground motions based on modal contributions are formulated. Linear filters representing ground transfer characteristics of seismic stations are investigated. Single-mode and 2-mode stochastic

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models are developed to permit prediction of random-type ground motions and the induced response statistics of structures. From the viewpoint of stochastic simulation, the autocorrelation function or the power spectral density function derived from the record accelerogram can be used to characterize the specific ground motion. By matching the power spectral density function of an existing ground motion record to that of the appropriate output of a linear single- or multi-degree-of-freedom system subject to white noise, predominant modal ground frequencies and dampings can be determined. (USBR)
W71-01319

8F. Concrete

FAILURE STUDY OF AN OVERLOADED 96 IN. CONCRETE PIPE,
California State Div. of Highways. Materials and Research Dept.
For primary bibliographic entry see Field 08A.
W71-01120

ALPE GERA DAM,
For primary bibliographic entry see Field 08A.
W71-01305

SMALL CONCRETE SPECIMENS UNDER REPEATED COMPRESSIVE LOADS BY PULSE VELOCITY TECHNIQUE,
For primary bibliographic entry see Field 07B.
W71-01310

EVALUATING EFFECTIVENESS OF CONCRETE CURING COMPOUNDS,
Pennsylvania State Univ., University Park.
R. E. Carrier, and P. D. Cady.
Journal of Materials, Vol 5, No 2, p 294-302, June 1970. 9 p, 8 fig, 4 ref.

Descriptors: *Curing compounds, Concrete technology, Petrographic investigations, *Relative moisture content, Laboratory tests, Moisture, Membranes, *Highways, Humidity, *Curing.
Identifiers: *Moisture sensors, *Concrete pavements, Cement hydration, Schmidt test hammer, *Curing-effectiveness gage, Concrete slabs.

Use of membrane-forming curing compounds has become a universal practice for concrete paving, but little is known about the effectiveness of varying application rates. Laboratory experiments are described in which slab specimens were cured with application rates varying from no coverage to 100 sq ft/gal in a controlled environment simulating severe summer exposure. As long as a continuous membrane is formed, the rate of application of the curing compound has little effect on curing effectiveness. This observation was supported by Schmidt hammer indications of surface strengths and by petrographic examinations. Beneath 1 in. below the membrane, the hydration process (curing) is sustained throughout the 28-day curing period independent of the thickness of the membrane. The upper 1 in. is of primary importance with respect to riding quality, safety, and aesthetics. To assure that the surface of a concrete pavement is being cured properly, a relative humidity-indicating button has been developed for insertion into fresh pavement surfaces. The device has performed well in laboratory tests and is currently undergoing field tests. (USBR)
W71-01311

PLASTICS IN CONCRETE TECHNOLOGY,
A. Witchlow, T. C. Van Hoorn, and P. E. Davies.
Concrete, Vol 4, No 1, p 12-21, Jan 1970. 10 p, 3 tab, 11 ref, 8 photo.

Descriptors: *Concrete technology, *Polymers, *Epoxy resins, Adhesion, *Plastics, *Resins, *Strength, *Durability, Construction materials,

Wear resistance, Hard surfacing, Emulsions, Repairing, Concrete additives, Foreign research, Concretes.
Identifiers: *Polyesters, *Concrete-polymer materials, Bond strength, *Polymer concretes, *Acrylic resins, Surfacing, Great Britain.

Plastic resins are being developed for use with concrete to increase strength and durability. The principal resins used are acrylic, epoxy, polyester, and polyvinyl acetate. Plastic resins are used for joining, improving the bond to and within concrete, and making hard-wearing surfaces. Polyvinyl acetate usually improves the properties of hydraulic binders, but if moisture is to be present for long periods, a copolymer of vinyl acetate and a vinyl ester of versatic acid should be used. Epoxy resins with hardeners are usually used for surface protection or repair. Surfaces must be carefully cleaned of dust, oil, or grease to obtain good adhesion. Epoxies may be used for bonding concrete to metal. A wide variety of resin formulations is available. (USBR)
W71-01383

INFLUENCE OF COMPRESSIVE STRESSES ON FROST RESISTANCE OF CONCRETE,
A. A. Goncharov, and V. S. Gladkov.
Translation of Beton i Zhelezobeton, No 5, p 37-39, 1969. Reclam Transl 825, July 1970. 14 p, 5 fig, 3 tab, 11 ref.

Descriptors: *Freeze-thaw tests, Hydraulic structures, Non-destructive tests, Reinforced concrete, *Concrete technology, Admixtures, Sea water, *Concrete testing, Foreign research, *Durability, Coastal structures, Water level fluctuations, Creep, Deformation, Air entrainment, Concrete additives.
Identifiers: USSR, *Compressive stress, *Frost resistance, Ultrasonic tests, Concrete properties, Spalling, *Freeze-thaw durability.

Durability of modern hydraulic structures subjected to changing water levels and alternate freezing and thawing under significant loading was studied at several Soviet laboratories. In addition to a review of the literature and a study of existing structures, laboratory tests for compressive stress, cracking, and frost resistance were conducted on specimens from 2 concrete mixes that were identical except for special additives to increase frost resistance. Ultrasonic testing was used for investigating cracking and loss of strength; creep deformation was measured by removable deformation gages. Test methods and conditions are described. Conclusions were that: (1) compressive stresses within a specific range will increase frost resistance of concrete without admixtures; (2) increased loads lower frost resistance; and (3) concrete with air-entraining admixtures can tolerate much higher compressive stresses without lowering frost resistance. (USBR)
W71-01393

CONCRETE IN A MARINE ENVIRONMENT.
Texas Transportation Inst., College Station.

Available from NTIS as PB-189 872, \$3.00 in paper copy, \$0.95 in microfiche Bibliography 1-195, November 1966. 7 p.
Identifiers: *Civil engineering, Concrete, *Concrete, Sea water, Sodium Chloride, Corrosion, Wear resistance, Reinforced concrete, Bibliographies, Abstracts.

The annotated bibliography of 14 items deals with the effect of seawater on reinforced concrete in relation to highway engineering.
W71-01509

8G. Materials

SCALE CONTROL IN HIGH TEMPERATURE DISTILLATION OF SALINE WATER USING FLUIDIZED BED HEAT EXCHANGERS,
Brookhaven National Lab., Upton, N.Y.

For primary bibliographic entry see Field 03A.
W71-01200

ASSEMBLY AND EVALUATION OF AN IMPROVED PPB OXYGEN ANALYZER FOR SEAWATER,
Dow Chemical Co., Freeport, Tex.
For primary bibliographic entry see Field 03A.
W71-01201

PLASTICS IN CONCRETE TECHNOLOGY,
For primary bibliographic entry see Field 08F.
W71-01383

8H. Rapid Excavation

RADIOACTIVITY IN WATER: PROJECT RULISON,
Teledyne Isotopes, Palo Alto, Calif.
For primary bibliographic entry see Field 05G.
W71-01136

8I. Fisheries Engineering

IMPORTANCE OF PROVISION WITH FOOD FOR THE SURVIVAL OF FISH LARVAE (ON AN EXAMPLE OF THE BREAM OF RYBINSK RESERVOIR),
Bureau of Sport Fisheries and Wildlife, Narragansett, R.I. Narragansett Marine Game Fish Research Lab.
For primary bibliographic entry see Field 02H.
W71-01506

09. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

THE NATION'S ENGINEERING RESEARCH NEEDS, 1965-1985.
Engineers Joint Council, New York.
For primary bibliographic entry see Field 06B.
W71-01169

PROCEEDINGS OF THE CONFERENCE WATER RESOURCES RESEARCH - 1970.
Connecticut Univ., Storrs. Inst. of Water Resources.

Available from NTIS as PB-195 667, \$3.00 in paper copy, \$0.95 in microfiche. William C. Kennard, editor. Connecticut University Institute of Water Resources Report No 13, September 1970. 20 p. OWRR Project A-999-CONN (8).

Descriptors: *Water resources research act, Connecticut, *Universities, *Abstracts, Water pollution treatment, Instrumentation, Waste disposal, Aeration, Erosion control, Water pollution sources, Water law, Algae, Dissolved oxygen.
Identifiers: Water resources research.

These Proceedings include abstracts of papers presented at the Conference held by the Institute of Water Resources at the University of Connecticut on May 18, 1970. The title of each presentation is the same as that of the research project. Also given for each are the personnel, academic departments, planned duration and the objectives of the investigations. Each abstract is a brief summary of accomplishments to date and plans for the future. The program of the Institute has become increasingly diverse in the approximately six years that it has been in existence. Projects in the agricultural, biological, engineering, earth, social and physical sciences have been or now are active. Continued expansion, both in scope of the research and in the number of projects, is planned. The results of these investigations will, in many cases, have direct appli-

Field 09—MANPOWER, GRANTS AND FACILITIES

Group 9A—Education (Extramural)

cation to solving problems of water resources use and development in Connecticut and will result in important contributions to the fund of scientific information about water in a broad range of disciplines. (Knapp-USGS)
W71-01192

10. SCIENTIFIC AND TECHNICAL INFORMATION

ANNOTATED LIST OF PUBLICATIONS, 1895-1970,
Illinois State Water Survey, Urbana.
J. Loreena Ivens.
Illinois State Water Survey Publication, April 1970.
84 p, 1 map, 2 index.

Descriptors: *Publications, *Bibliographies, *Information retrieval, Water resources, Illinois, Documentation, Hydrology, Hydraulic systems, Water quality, Atmospheric physics.
Identifiers: Water Survey reports, Citations.

This is a very useful historical and current guide of literature issued by the Illinois State Water Survey. Three formal series of publications are issued: Bulletins, Reports of Investigations, and Circulars. A Miscellaneous Publications category includes technical letters and brochures, and a series of Contract Publications are for final reports requested by granting or contracting agencies and published in small quantities primarily for their use. In this booklet publications in each series and group are listed and briefly described starting with the most recent issues. Out-of-print reports are

mostly available on a loan basis. This booklet contains 498 items. (Lang-USGS)
W71-01105

EARTH RESOURCES RESEARCH DATA FACILITY INDEX.
National Aeronautics and Space Administration, Houston, Tex. Manned Spacecraft Center.
For primary bibliographic entry see Field 07C.
W71-01206

BIOLOGICAL WASTE TREATMENT IN THE FAR NORTH,
Federal Water Quality Administration, College, Alaska. Alaska Water Lab.
For primary bibliographic entry see Field 05D.
W71-01262

PROGRESS IN HEAT TRANSFER - REVIEW OF 1969 LITERATURE,
J. A. R. Henry.
Chemical and Process Engineering - Heat Transfer Survey, 1970, p. 19-26, 162 ref.

Descriptors: *Heat transfer, *Bibliographies, *Reviews, Conduction, Convection, Motivation, Evaporation, Heat exchangers, Condensation, Mathematical models, Reynolds number, Temperature, Mass transfer, Momentum transfer, Boiling, Cooling.
Identifiers: Literature review.

The literature review based on 162 selected papers from 8,000 articles is presented here. The article is

divided up under the headings of conduction, radiation, convection change of phase, multi-phase flow and heat exchangers. (Novotny-Vanderbilt)
W71-01344

CONCRETE IN A MARINE ENVIRONMENT.
Texas Transportation Inst., College Station.
For primary bibliographic entry see Field 08F.
W71-01509

AN EXPERTISE SYSTEM FOR THE MARINE RESOURCES INFORMATION CENTER,
Texas A and M Univ., College Station.
Eugene B. Smith, and Johnny H. Butler.
Available from NTIS as PB-190 080, \$3.00 in paper copy, \$0.95 in microfiche. Sea Grant Publication No 207, January 1970, various pagings. 6 ref. Grant NBS-GH-59.

Identifiers: *Technical information centers, Manpower, *Personnel management, Technical information centers, Professional personnel, Questionnaires, Marine Resources Information Center.

The expertise file of the Marine Resources Information Center is one attempt to make information available on the people resource associated with marine resource development. While the population from which the file was assembled is relatively small, it is felt that the experience obtained in the usage of the information will be of value in later expansion and modifications of the system. The expertise file should prove to be of considerable value in providing the potential for a better utilization of existing manpower and skills in the area of marine resource development.
W71-01534

SUBJECT INDEX

ABANDONMENT STEINBRAKER V CROUSE (ABANDONMENT OF PROPERTY IN NAVIGABLE WATERS). W71-01468	06E	WATER POWER AND CONTROL COMM'N V NIAGARA FALLS POWER CO (LICENSING OF POWER COMPANIES). W71-01564	06E
ABSTRACTS PROCEEDINGS OF THE CONFERENCE WATER RESOURCES RESEARCH - 1970. W71-01192	09A	CAPLES V TALIAFERRO (OWNERSHIP OF SUBMERGED LANDS). W71-01590	06E
ACCESS ROUTES SOUND MARINE AND MACHINE CORP V WESTCHESTER COUNTY (INTERFERENCE WITH RIGHT OF ACCESS TO AND FROM NAVIGABLE WATERS). W71-01455	06E	APPLICATION OF GILLESPIE (COMPENSATION TO NEIGHBORING LANDOWNER FOR CONSTRUCTION OF AQUEDUC). W71-01627	06E
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TURK V WILSON'S HEIRS (TITLE DISPUTE TO ACCRETION FORMED IN MISSISSIPPI RIVER). W71-01586	06E	AERATION INSTREAM AERATORS FOR POLLUTED RIVERS. W71-01342	05G
ANDERSON-TULLY CO V CAMPBELL (BOUNDARY DISPUTE AS TO OWNERSHIP OF ACCRETION). W71-01591	06E	AERIAL PHOTOGRAPHY SPECTRAL SURVEY OF IRRIGATED REGIONAL CROPS AND SOILS ANNUAL REPORT, 1 OCT. 1968-30 SEP. 1969. W71-01539	07B
UNITED STATES GYPSUM CO V REYNOLDS (CHANGE OF RIVER BED OVER LONG PERIOD OF TIME PRESUMED TO BE BY EROSION AND ACCRETION). W71-01593	06E	AERIAL RECONNAISSANCE RADIOMETRIC DETECTION OF OIL SLICKS. W71-01144	05A
ISELIN V LA COSTE (TITLE TO ACCRETIVE LANDS). W71-01598	06E	AESTHETICS COASTAL CHANGES. W71-01366	06B
MERIDIAN TOWNSHIP V PALMER (PUBLIC EASEMENT ACROSS RELICTION). W71-01607	06E	AFRICA ON THE BIOLOGY OF THE DESERT TORTOISE TESTUDO SULCATA IN SUDAN. W71-01404	02I
SHELDON V CHAMBERS (TITLE TO SUBMERGED LAND). W71-01609	06E	AFRICAN HERRIVORES PLEISTOCENE NICHES FOR ALIEN ANIMALS. W71-01402	03F
PLATTSMOUTH BRIDGE CO V GLOBE OIL AND REFINING CO (OWNERSHIP OF ACCRETIVE LANDS). W71-01613	06E	AGGRADATION COMPUTER SIMULATION OF RIVERBED DEGRADATION AND AGGRADATION BY THE METHOD OF CHARACTERISTICS. W71-01212	02E
ACID MINE WATER REGULATION OF POLLUTION BY MINE WASTES. W71-01570	06E	ESTIMATION OF RIVER BED AGGRADATION DUE TO A DAM. W71-01214	02J
ACRYLIC RESINS PLASTICS IN CONCRETE TECHNOLOGY. W71-01383	08F	AGRICULTURAL RESTORATION OF LOST AND DEGRADED HABITATS. W71-01367	06G
ACTIVATED SLUDGE BIOLOGICAL WASTE TREATMENT IN THE FAR NORTH. W71-01262	05D	AGRICULTURAL ORIGINIS ENVIRONMENTAL CHANGES AND THE ORIGIN OF AGRICULTURE IN THE NEAR EAST. W71-01403	02B
BIOLOGICAL UPTAKE OF PHOSPHORUS BY ACTIVATED SLUDGE. W71-01474	05D	AGRICULTURE THE NATURE AND DISTRIBUTION OF FARMING IN NEW YORK STATE. W71-01133	03F
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06E	W71-01456	02B	W71-01521	06E	W71-01586		
06E	W71-01457	05A	W71-01522	06E	W71-01587		

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A. Center of Competence		
U.S. Geological Survey - Hydrology	W71-01101--01114 01203--01208 01210--01230 01232--01236 01238--01248 01250--01261 01324--01332 01116, 01545 01546	81
University of Arizona - Arid Lands Water Resources	W71-01280--01281 01283--01295 01297--01299 01394--01409 01341	35
University of Wisconsin - Eutrophication	W71-01374--01378 01472--01500	34
Bureau of Reclamation - Engineering Works	W71-01304--01306 01310--01312 01314--01323 01301, 01308 01379--01381 01383, 01385--01391 01393	30
University of Washington - Water Quality Requirements for Aquatic Organisms	W71-01267--01268 01270--01277 01279	11
Vanderbilt University - Thermal Pollution	W71-01342--01344	3
Rutgers - the State University - Water Resources Economics	W71-01345--01355 01410	12
University of Chicago - Metropolitan Water Resources Management	W71-01363--01373	11
University of Florida - Eastern U.S. Water Law	W71-01412--01471 01547--01650 01115, 01122 01123, 01131 01134, 01138 01139, 01150 01147--01149 01153, 01155 01158, 01165 01175, 01181 01182, 01184 01209, 01231 01237, 01249 01269, 01278 01282, 01296 01302, 01303	209

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A. Center of Competence (Cont'd)		
University of Florida - Eastern U.S. Water Law (Cont'd)	W71-01307, 01309 01313, 01356 01357, 01361 01362, 01382 01384, 01392 01502, 01518 01519, 01520 01536	
B. State Water Resources Research Institutes		
California Water Resources Center	W71-01188--01189	2
North Dakota Water Resources Research Institute	W71-01190	1
Florida Water Resources Center	W71-01191	1
Connecticut Institute of Water Resources	W71-01192	1
Kansas Water Resources Research Institute	W71-01195	1
Wisconsin Water Resources Center	W71-01196--01197	2
Minnesota Water Resources Research Center	W71-01300, 01358	2
New Jersey Water Resources Research Institute	W71-01340	1
North Carolina Water Resources Research Institute	W71-01359--01360	2
Washington Water Research Center	W71-01411	1
C. Others		
Environmental Protection Agency	W71-01262--01266 01544	6
Office of Saline Water	W71-01198--01202	5
Engineering Aspects of Urban Water Resources (Poertner)	W71-01333--01339	7
Office of Water Resources Research	W71-01193--01194	2

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1. General Information

Project Name: [illegible]

Project Number: [illegible]
Project Manager: [illegible]
Project Start Date: [illegible]
Project End Date: [illegible]
Project Status: [illegible]

2. Project Objectives

Objective 1: [illegible]
Objective 2: [illegible]
Objective 3: [illegible]
Objective 4: [illegible]
Objective 5: [illegible]
Objective 6: [illegible]
Objective 7: [illegible]
Objective 8: [illegible]
Objective 9: [illegible]
Objective 10: [illegible]

Objective 1: [illegible]
Objective 2: [illegible]
Objective 3: [illegible]
Objective 4: [illegible]
Objective 5: [illegible]
Objective 6: [illegible]
Objective 7: [illegible]
Objective 8: [illegible]
Objective 9: [illegible]
Objective 10: [illegible]

3. Scope

Scope Item 1: [illegible]
Scope Item 2: [illegible]
Scope Item 3: [illegible]
Scope Item 4: [illegible]
Scope Item 5: [illegible]

Scope Item 1: [illegible]
Scope Item 2: [illegible]
Scope Item 3: [illegible]
Scope Item 4: [illegible]
Scope Item 5: [illegible]

CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Water Resources Division of the U.S. Geological Survey, U.S. Department of the Interior.
- Metropolitan water resources management at the Center for Urban Studies of the University of Chicago.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Research Institute of Rutgers University.
- Design and construction of hydraulic structures; weather modification; and evaporation control at the Bureau of Reclamation, Denver, Colorado.
- Eutrophication at the Water Resources Center of the University of Wisconsin, jointly sponsored by the EPA, Soap and Detergent Association, and the Agricultural Research Service.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.

Supported by the Environmental Protection Agency in cooperation with WRSIC.

- Thermal pollution at the Department of Sanitary and Water Resources Engineering of Vanderbilt University.
- Textile wastes pollution at the School of Textiles of North Carolina State University.
- Water quality requirements for freshwater and marine organisms at the College of Fisheries of the University of Washington.
- Wastewater treatment and management at the Center for Research in Water Resources of the University of Texas.
- Agricultural Livestock Wastes at the Department of Agricultural Engineering of Iowa State University.

Subject Fields

- 1 NATURE OF WATER**
- 2 WATER CYCLE**
- 3 WATER SUPPLY AUGMENTATION AND CONSERVATION**
- 4 WATER QUANTITY MANAGEMENT AND CONTROL**
- 5 WATER QUALITY MANAGEMENT AND PROTECTION**
- 6 WATER RESOURCES PLANNING**
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